Cabinet Office
Advisory Council for Applied Research and Development

Facing International Competition

The Impact on Product Design of Standards, Regulation, Certification and Approvals

July 1982

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First Published 1982

ISBN 0 11 630783 8

Preface

Manufacturing industry is faced with a large volume of standards and regulations which in an industrialised society are complex and wide-ranging. Standards and regulations, both domestic and foreign, closely affect the design of products – the stage at which the manufacturer decides how to satisfy the requirements of his chosen market. Customer requirements may therefore compete with non-customer requirements, such as regulation, for the manufacturer's creative technical and management resources and this conflict together with the demands and opportunities presented by non-customer requirements, affects the competitiveness of UK manufactures.

Technical and administrative resources are devoted to creating and supporting regulations, standards and codes of practice in both the public and private sectors, and their organisation and methods of working should be beneficial to manufacturing industry. The relationship of engineering and industrial design with regulatory factors is close, and ACARD wished to examine whether there were measures for further fostering design and competitiveness. There might be new initiatives, for example much wider adoption of quality management standards and product approval schemes, which would lead to improvements in the international competitiveness of British products.

ACARD therefore set up a Working Group with terms of reference to:

> Examine the influence of regulations enforced by the UK's major trading competitors on the design of products for international markets;
>
> Assess ways in which manufacturing companies identify and conform to differing national and international requirements affecting their products, and the research, design, development and production implications of doing so;

Consider the activities by which UK regulations and codes of practice bearing on the design of products are created and enforced; what changes might lead to improved competitiveness of UK manufactured products; and

Make recommendations

The membership of the Working Group was –

*Dr B C Lindley CBE (Chairman)	Director of Technology, Dunlop Holdings plc
Mr G E P Constable	Head of Industrial Division, Design Council
Mr J D Johnson	Director, TI Group plc
Dr I D Nussey	Manager, Warwick Support Group, IBM United Kingdom Ltd
Mr K R Peplow	Director, British Industrial Fasteners Federation
Mr G White	Director, Redland plc (until 8 April 1982)

*ACARD member

We adopted two complementary approaches to this study. First, we considered some of the means by which UK regulations and codes of practice affecting product design are created and enforced. To do this we invited the views of UK organisations and institutions whose activities and interests cover the field of standards, regulations and quality. Oral and written representations were made by these bodies and some individuals. Second, we assessed the ways in which some companies identify and comply with differing national requirements affecting their products, and the research, design and development implications of so doing. The method we chose was to undertake a series of structured interviews with UK firms in four sectors:

- electrical and electronic components
- videotex systems
- industrial fasteners
- metal and plastic-framed windows.

The selection was made to bring out various representative aspects of this broad subject including: pervasiveness in manufacturing; high added value; international tradability or trading potential; and, in all of them, design and quality as being important to their international competitiveness. The evidence received and our general conclusions are very much wider than from these four product sectors. We have however limited the scope of our study primarily to industrial artefacts and excluded food and pharmaceutical products. We have also given only limited consideration to manufacturing processes, while recognising the growing influence of new technology on manufacturing systems and processes.

In the formative stages of the study we had the benefit of Sir Frederick Warner's advice. The Working Group subsequently met 10 times between August 1981 and May 1982. We received 28 submissions from firms, institutions and individuals – some of them unsolicited – and members conducted 40 detailed interviews. We also retained a consultant to obtain information on the international scene. (A list of contributors is at Annex D.) While the formal evidence is summarised in Section 5, much of the factual material supplied is used elsewhere in the report.

Following the summary and introduction, Section 2 of the report contains an account of the current activities and organisation in the standards and regulatory field for the UK. The resource implications of UK standards and regulatory activities for the public and private sectors are discussed in Section 3. In Section 4 related national activities of some of our major overseas trading competitors are described. The evidence submitted by organisations and individuals is summarised in Section 5. The main points from the sector studies are summarised in Section 6, with the study reports being set out in full in Annex C.

The Working Group's report was endorsed by ACARD in May 1982. It has been submitted to the Government for their consideration, and is now published to draw attention to the economic importance of this subject and to the recommendations for action. Like previous ACARD publications, this report highlights principal issues and is not intended as a comprehensive survey. The Council are grateful to the Working Group for their examination of a wide and complex subject. They also wish to acknowledge the support given by the Central Policy Review Staff and the ACARD Secretariat in the Cabinet Office.

Contents

(The opening paragraph number of each subsection is shown in brackets)

PREFACE

SUMMARY

1. **Introduction**

Design, standards and regulation (1.1)
The purpose of regulations and standards (1.8)
Making standards and regulations (1.13)

2. **The current UK scene**

Measurement standards and legal metrology (2.2)
Specification standards (2.5)
Certification and approvals schemes (2.11)
Quality assurance schemes and systems standards (2.17)
Codes of practice (2.19)
The legislative background (2.20)
Product liability legislation (2.25)

3. **Industrial resources allocated to standards and regulatory work**

Availability of data (3.2)
Resources allocated to standards (3.3)
The costs and benefits of quality (3.6)
Costs of certification and approval in perspective (3.8)
Direct costs of certification (3.10)
Benefits of certification and approval (3.15)

4. Practices in other countries

France (4.4)
West Germany (4.7)
Japan (4.13)
United States (4.19)
International co-operation (4.24)

5. Summary of submissions

The British culture and attitudes (5.2)
Design (5.4)
Market requirements (5.5)
British Standards and standards-making (5.8)
Regulations (5.13)
Certification and approval (5.17)
Quality assurance and capability assessment (5.21)
Non-tariff barriers to trade (5.24)
Education and training (5.27)
Dissemination of information (5.29)

6. Product sector studies

Overseas requirements (6.2)
International standards (6.5)
British Standards (6.8)
Regulations (6.12)
Quality assurance (6.15)
Certification and approval (6.17)
Quality (6.20)
Product liability (6.22)
Education and training (6.23)

7. Conclusions and recommendations

The framework for competitive product design (7.1)
Information (7.4)
Quality management systems for companies (7.7)
Product certification and approval (7.9)
Accreditation of product certification and approvals schemes (7.10)
Regulations and their making (7.14)

Public sector purchasing (7.18)
British Standards and standards-making (7.22)
Government responsibilities related to standards (7.29)
Education and training (7.32)
Co-ordination (7.34)

ANNEXES

A. The terminology of standards and regulations
B. Standards for standards and quality management systems
C. Product sector study reports
D. List of organisations and individuals submitting evidence
E. List of abbreviations.

Summary

1. The central conclusion of our report is that excellence in design and quality is essential if British manufactured products are to be internationally competitive both at home and in export markets. But excellence alone is not enough. It must be demonstrated in ways that command the respect of purchasers, especially those overseas. Schemes to *certify* products to reputable British or international product standards are one way. *Approval* schemes based on wider criteria, such as those operated by the Design Council, are another. A few schemes already exist in this country; we conclude that there should be many more.

2. Although it is primarily for non-governmental bodies to establish and operate certification and approval schemes and to generate the standards on which they depend, governments are inescapably involved. In the economies of many countries, about half the tradeable goods are purchased by government departments and agencies. In judging the credibility of product certification or approval schemes, public purchasers will look for their recognition in some way by the government of the country where they operate. Primarily, that government should make use of such schemes in its own procurement and, where appropriate, also in enforcing compliance with regulations at home. But, in addition, the procedures which schemes use should be of a high professional standard and periodically audited in a way which the government can recognise or accredit.

3. In summary, British Standards should embody good and sound industrial practice for the manufacture of well designed products. They should be seen to have this role in industry and by government. Both will need to work towards these goals, government to create a better administrative framework which supports and uses standards and certification and approval schemes to a far greater extent than at present. Industry and the professional bodies for their part must devote greater efforts to generating British Standards and establishing approval schemes, pitching them at a level which will make Brit-

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ish products more competitive in their design and quality. Section 7 of the report argues the case for 27 recommendations in support of these goals. Taken as a whole, they describe the partnership between government and industry which we believe is necessary if our manufacturers are to be successful in facing international competition.

1 Introduction

Design, standards and regulation

1.1 Britain's share of world trade has declined markedly over the past 20 years. While the price of products is a determinant of international success, it is by no means the only one. All non-price factors – reliability, fitness-for-declared-purpose, delivery, ease of maintenance and many more key elements – are also affected, and many are determined, by the initial design. Good design is therefore crucial to market success.

1.2 Expertise in design and technology is needed in marketing so that thoroughly satisfactory product specifications can be produced as a result of market investigations. International horizons are needed instead of a limited view of supposedly captive markets, very few of which still exist at home or overseas. Without a global view of markets, firms may have to re-design products to meet unexpected requirements – such as those of a new market – which can be very expensive, far more so than incorporating the features concerned in a more comprehensive initial design.

1.3 In addition, industry must give greater attention to quality and quality assurance. At a time when industry's costs are under great pressure, the cost involved in re-working or scrapping products which fail to meet specification deserves close scrutiny. Several £100M's could be saved each year in the mechanical engineering sector alone through adopting better quality procedures. Incorporating quality and good manufacturing practice in the initial design, and maintaining these through soundly-based quality management, can increase the margin between input and output costs, thereby improving profitability.

1.4 Non-price factors have become increasingly important in a customer's evaluation of value-for-money when assessed over a manufactured product's usable life. For example, the costs of servicing, repairs and down-time have risen, particularly for manufacturing plant, and customers are increasingly willing to pay a higher initial price if operating costs and failure penalties will be reduced. Standards for safety, pollution control, energy economy and other aspects of performance and environmental impact have become progressively more rigorous world wide. Products designed without regard to these trends will be less saleable, regardless of price. More specifically, different nations have differing requirements which products must meet. These include mandatory safety regulations and standards, customers' specifications, and more general cultural expectations of purchasers regarding quality and reliability, as well as other factors such as price and country of origin.

1.5 Standards, regulations and other requirements in the UK have a major effect on the acceptability of UK products in home and international markets. Products made to a stringent British Standard may have a competitive edge over foreign products in terms of quality and performance, but may cost more. Conversely, products made to a less demanding British Standard might be cheaper but lack the performance or quality which some markets require. Overall success depends on the accurate assessment of market requirements on the part of manufacturers and the recognition by government that standards and regulations made in the UK have far-reaching commercial consequences for the products they cover.

1.6 The development of products and processes for market needs is underpinned by research and technology. The knowledge and practical experience so acquired can, on the one hand, serve as the technical basis of regulations to limit the harmful effects of technology and, on the other, be codified in standards to inform and guide other workers. Standards and regulations also feed back into the development of technology and trade because, by harmonisation of product features, markets are enlarged and the spread of technology encouraged.

1.7 Devising, administering and complying with standards and regulations requires skilled people. Manufacturers are involved both in preparing and applying UK standards and regulations, and in complying with the requirements of other countries. In the public sector, further resources are devoted to administering the national standards and regulatory systems. Some of these resources might otherwise be devoted to research, design and development and thereby the creation of wealth.

The purpose of regulation and standards

1.8 Regulation (as defined in Annex A) fulfils several functions. It is, inter alia, an instrument of governments wishing to influence commerce and control the use of technology. An early example was the requirement in a statute made after the Great Fire of London that all external walls of buildings in London should be of brick or stone, which affected domestic building for a long period. Previously the only constraint on building technology had been tradition, and this was found in 1666 to be inadequate. For similar reasons, statutes (primary legislation) were later introduced controlling transport, public health and working conditions in manufacturing companies (for example, the use of child labour). The next logical steps were delegated legislation (regulations) and the establishment of inspectorates, eg of factories, with a great deal of discretion left to the inspectors. In summary, as the pace of technological development has increased, so has the need for regulation. It now pervades most of the activities of industry, and it ought to be formulated so as not to constrain industrial performance unnecessarily.

1.9 Present regulations in the UK cover such subjects as: the prevention of radio interference; the carriage of dangerous goods; fire-fighting equipment on offshore installations; as well as subjects beyond the scope of this study such as additives in bread and flour. These examples reflect developments in technology over the last 60 years and illustrate the need which successive governments have identified to limit the harmful effects of technology on a complex society.

1.10 Standards (as defined in Annex A) can be used for a number of purposes, one of which is to simplify the operation of government regulatory bodies. Standards may define those attributes of products and processes which affect health, safety and the environment and provide agreed test methods and criteria for assessment. Reference to standards can provide regulatory bodies with an economical means of expressing their requirements, and may also help to simplify the process of enforcement. To this extent, use of standards is in the interests of the regulatory agencies.

1.11 Standards can in addition be used for other purposes. The original motive for the establishment of national standards bodies in the major trading countries, including the UK, was to ensure compatibility and interchangeability, and is still probably the strongest force favouring the adoption of standards. This applies to all three kinds of standards (measurement, product specification and systems) and, in many areas of manufacturing, this function of standards is a prerequisite for international trade. An accepted set of measurement standards is crucial if components and assemblies made in one location are to fit and match with those from another. Specification standards make known the design or performance characteristics required of a product both to home and overseas manufacturers. System standards can ensure that common and defined levels of quality are attained by suppliers of components, assemblies or finished products which form part of a larger system – such as in aerospace and defence-related industries. But standards can also serve –

a. to improve the quality of products. A standard which clearly specifies the customers' needs is an important contribution to quality. Once the important product features are defined in a standard, products can be tested and their compliance with the standards certified. Quality management systems can be introduced to ensure that the manufacturer is capable of consistently producing to the required standard.

b. to facilitate international trade. The extent to which the nation's body of standards and regulations is recognised and enforced at home can have a considerable effect on their recognition abroad and thus affects the home manufacturers' ability to sell in overseas markets. In addition, national standards can be marketed overseas in several ways including the direct sale of standards portfolios (and the infrastructure necessary to adopt them), or indirectly through the education of overseas students in technological subjects.

c. to promote manufacturing efficiency. General adoption of a standard can reduce the variety of products made for the same purpose, creating thereby economies of scale and also reducing waste. The imperial and metric systems of measurement provide an example having widespread implications for the engineering industries, since metrication opens up potentially larger overseas markets for UK products. It has been estimated that a UK engineering firm could typically save around 3 per cent of turnover through standardising on a single measurement system.

d. to encourage investment in capital and other resources. An assurance of the widespread acceptability of standardised products provides a more secure base for productive investment.

e. to provide guidance on design requirements to engineers and designers as to the accepted rules of technology, for example under product liability legislation. Compliance with standards might also constitute a prima facie defence for manufacturers in law, and facilitate some mitigation of insurance premiums.

1.12 Although standards are technical in content, they almost always have important commercial implications. In most countries, domestic suppliers have a natural advantage over importers in understanding the requirements and expectations of their own markets. Such requirements may act as non-tariff barriers to trade, albeit unintentional. In addition their governments may acquiesce in institutional arrangements which provide a means of deliberately erecting trade barriers, despite the General Agreement on Tariffs and Trade (GATT) and the provisions of the Treaty of Rome. The National Economic Development Council and its sector working parties have repeatedly affirmed that the UK should strive for free and fair trade but they concede that, in the short term, UK firms may need some degree of protection against the restrictive practices of other countries. Mandatory national certification and approval schemes are one way of achieving this protection. For the longer term, negotiating mutual recognition between countries of each others' certification and approval schemes provides a way to achieve open trading, while preserving national safety and analogous requirements.

Making standards and regulations

1.13 National specification and system standards are made by a voluntary consensus process of debate and negotiation amongst those who are expert in both the technical field of the standard and in the commercial aspects of the area of trade concerned. In the UK, as in many other countries, such standards do not automatically have any status in law. Their adoption is voluntary and depends very much on their content and timeliness. A standard which is technically deficient will not be adopted; and in particular, the participants in the standards-making process are not bound either to manufacture to it or, as purchasers, to give it preference. A standard which is too early risks delaying innovation. One which is too late will miss the market because there is already a large investment in products made to other standards. International standards are made by similar consensus procedures among national standards bodies and the extent to which they are adopted as national standards is a matter for national standards bodies themselves.

1.14 Regulations in the UK are often developed using processes of consultation similar to standards-making, but the final form of the regulation is determined by the regulatory body rather than by consensus between all the interested parties. There are no requirements for these bodies to make use of an existing standard, either in whole or in part, although reference to standards in regulations is being encouraged. The enabling legislation covering the regulations will generally empower the regulatory body to define the means of assessing compliance, the way in which this is to be carried out, and to determine what shall be done in the event of non-compliance. Enforcement may be carried out by the regulatory body itself or delegated to others. For example, regulations made by the Secretary of State for Trade under the Consumer Protection Act are enforced by local authority Trading Standards Officers.

2 The current UK scene

2.1 The standards and regulatory environment in any industrialised society such as the UK is necessarily wide-ranging and has become increasingly complex. In this section we review the UK institutions and the regulatory framework within which they work, explore the interlocking nature of their activities, and identify a number of features bearing upon the competitiveness of British products.

Measurement standards and legal metrology

2.2 In the UK, *measurement standards* are largely the responsibility of the National Physical Laboratory (NPL) together with the National Engineering Laboratory (NEL), both part of the Department of Industry. The measurement standards are made available to industry either through direct certification of calibrations by NPL/NEL of industrial standards and measuring instruments against NPL's reference standards, or through the British Calibration Service (BCS). BCS is a nationwide system of about eighty standards laboratories, mostly in the private sector, which have been approved and accredited by NPL as capable of carrying out measurements to stated accuracies. BCS was the first national calibration service, and has been copied extensively in other countries. It is currently beginning to negotiate bilaterally with a number of countries for mutual recognition of calibration certificates, which should aid the export of UK-made instruments. NPL also liaises with overseas national standards laboratories and periodically compares the UK's national standards with those of other countries to maintain international consistency in measurement.

2.3 The UK *legal metrology* activities have so far been regarded as separate from the science of metrology. The Weights and Measures Act lays down that certain classes of instruments (such as beer measures, petrol pumps and weighing scales) which are used for measuring quantities of goods that are bought or sold, must be fit for the purpose of trade. In practice, this means that they must be accurate within defined limits. All measuring equipment which falls within the scope of the Weights and Measures Act must be approved by the Department of Trade, which assesses production prototypes at its National Weights and Measures Laboratory (NWML) in London. The NWML is under an obligation to compare its own measurement standards, upon which it bases its assessment of the measurement accuracy of equipment, against the primary standards which are held by the NPL. Where NWML cannot perform certain tests it calls on the help of the NPL and NEL.

2.4 The European Community (EC) has produced several directives affecting legal metrology which establish community-wide approval criteria for instruments such as weighing machines and electricity, water and gas meters. Manufacturers can have their products approved to these criteria at any EC national weights and measures laboratory within the EC and then they are free to sell their products in any Community country.

Specification standards

2.5 Much of the preparation of specification standards is undertaken by the British Standards Institution (BSI). The BSI is a chartered body and is sponsored by the Department of Trade, which makes a grant-in-aid that matches industrial subscriptions for its standards-making work (income about £8.2M in 1980/81). These two elements are each about 25 per cent of BSI's standards income, the remaining 50 per cent deriving from sales of standards documents and related items. (Other aspects of BSI's work are mentioned later.) Specification standards are written by technical committees of the BSI, which include representatives from manufacturers, users, regulatory bodies and consumer groups, together with technical specialists – often from Government laboratories or from research organisations. These technical committees are serviced by the BSI Secretariats, and the BSI takes responsibility for printing and publishing standards and drafts.

2.6 The standards-writing process proceeds by consensus and may often be protracted. Draft standards, which may be original or based on industry or international standards, are prepared by an appropriate interested body for the technical committee. Industry itself and the Research Associations provide an essential source of technical expertise for standards-making, as well as undertaking research required for the preparation of standards and contract work for certification and approvals bodies. Draft standards are published for consultation with interested parties and after a period the standard is finalised through established procedures and then published as a British Standard.

2.7 The BSI sells British Standards to industry and the public and also maintains a reference library of overseas standards. Additionally, BSI actively promotes the use of British Standards in other countries, particularly in less developed countries, and provides contractual support to other countries' standards-making organisations.

2.8 As well as providing specification standards, the BSI operates an export advisory service – Technical Help to Exporters (THE). This service, which receives 20 per cent of its income in the form of a grant from the British Overseas Trade Board, provides assistance to exporters in identifying, translating and publishing overseas standards, codes and regulations, as well as the provision of complete documentary information for particular product areas.

2.9 The BSI is the UK member body of the International Organisation for Standardisation (ISO) and the European Committee for Standardisation (CEN). BSI's Electrotechnical Council forms the UK national committee of the parallel electrotechnical organisations, the International Electrotechnical Commission (IEC) and the European Committee for Electrotechnical Standardisation (CENELEC).

2.10 Member bodies exercise their discretion whether or not to participate in the work of these international bodies, and whether to implement nationally the standards which they publish. Unlike the BSI whose standards are the result of consensus, the international bodies use various voting systems, but (in all but CENELEC) member bodies who vote negative (or do not participate at all) are not required to implement the resulting standards nationally. The European Standards published by CEN and CENELEC – to which EC and EFTA member countries may contribute – are published without variation by those CEN member bodies who approve them as national standards, and in CENELEC are published with national deviations.

Certification and approvals schemes

2.11 Unlike most industrialised countries, the UK has few government supported national certification or approval schemes; and those that exist are mainly concerned with safety. A good example is the Airworthiness certification of civil aircraft by the Civil Aviation Authority (CAA). The CAA staff who develop Airworthiness Requirements are, in the main, the same staff who apply the requirements in a certification. They maintain a close relationship with their industry and are kept up to date in their field of specialisation. New requirements are published for consultation before they are approved and published. By international convention, national certificates of airworthiness are recognised by other countries provided they equal or exceed the standards established under the convention. Additionally, for the last ten years, a group of ten European countries have co-operated in the development of a common set of Joint Airworthiness Requirements for use in certificating one another's products in Europe. These are also aimed at minimising differences between European and American Airworthiness Requirements, but differ when there is consensus in Europe that the American Standard is inappropriate.

2.12 Examples of mandatory certification are few in the UK. There are, however, a number of industry-wide or sectoral schemes certifying compliance with specifications or safety standards. For example, electrotechnical approvals schemes are operated through the British Electrotechnical Approvals Board (BEAB), the British Approvals Scheme for Electrical Equipments in Flammable Atmospheres (BASEEFA), the British Approvals Service for Electric Cables (BASEC), and the Association of Short Circuit Testing Authorities (ASTA). These schemes operate respectively in the areas of household electrical equipment; electrical equipment for use in flammable atmospheres (except mines); electrical cables; and electrical conduit, controlgear, fuses and cable accessories. All the schemes have their own certification marks. BASEEFA is a part of the Health and Safety Executive (HSE) and is operated 'to assist the electrical engineering industry' as well as to aid enforcement. Approval under these schemes is not required by law, but there are often strong purchaser preferences for approved products.

2.13 Perhaps the best known certification schemes are those of the BSI, operated through its self-financing Quality Assurance Division (QAD) which uses the widely known BSI Kitemark to certify compliance with an underlying British Standard and the Safety Mark for compliance with British Standards for safety which generally relate to harmonised European Community standards. In the case of a few products (eg vehicle windscreen glass, motorcycle crash helmets) its use is made mandatory through legislation but, apart from these cases, it carries no government backing. BSI licenses the use of its Kitemark to manufacturers who comply with the requirements of their certification schemes and verifies the manufacturers' capability of consistently producing to the standard by sample testing, surveillance of manufacturers' facilities and periodic spot checks.

2.14 Another widely known scheme is that operated by the Design Council. The Design Council is a Government sponsored body, receiving a grant-in-aid from the Department of Industry. 'Design Centre Selected' products (about

7,000 in all) carry the black and white triangular Design Centre label which confers significant promotional benefits. Products submitted for approval are assessed by independent committees on broad criteria of good design, performance in use, construction, aesthetics and value for money. As part of the assessment process, the Design Council considers compliance with relevant British Standards and it submits products for independent testing, though it does not generally require certification of compliance with standards. Again such selection carries no statutory backing or Government endorsement, nor does it guarantee a manufacturer's ability to produce to consistent quality. The Design Council's Street Furniture Catalogue is used by the Department of Transport (DTp) to compile a buyers' guide. If local authorities wish to buy street furniture and wish to receive a DTp grant, then they must select from the buyers' guide. Additionally, some local authorities use the catalogue to compile their own preferred buying lists.

2.15 The Agrement Board, which is sponsored by the Department of the Environment (DOE), operates a national scheme for assessment and certification of innovative building products for which British Standards have not yet been written. The Board carries out independent testing of building products, materials and systems and, in consultation with DOE, may publish an opinion on their compliance with Building Regulations under defined conditions of use. But Agrement Certificates have no status in law and indeed, until recently, public sector purchasers did not specify Agrement certificated products.

2.16 Operation of approvals and certification schemes generally requires the use of a test laboratory to assess the product. There are many such laboratories in the UK, including the BSI(QAD) facility at Hemel Hempstead. To facilitate widespread acceptance of, and to assure, the professional competence of laboratories, the Department of Industry, through the National Physical Laboratory, has set up and runs the National Testing Laboratory Accreditation Scheme (NATLAS). Accreditation will be granted to laboratories which satisfy certain requirements concerning staff, equipment, general facilities and management. Membership is open to any laboratory conducting objective tests, whether it is independent or part of a larger organisation, public or private. The development of NATLAS is part of a growing international awareness of the value of accreditation systems as a means of promoting international trade. Through the International Laboratory Accreditation Conference, representatives from countries and international bodies exchange information on laboratory accreditation procedures and discuss means of developing mutual confidence in each others' systems.

Quality assurance schemes and systems standards

2.17 Historically, quality assurance in the UK has been driven by purchaser requirements. For many years, major public purchasers, such as the Ministry of Defence and nationalised industries, have operated capability assessment schemes to monitor their suppliers. These normally require that suppliers meet and maintain certain minimum standards of process quality, inspection standards and administration, as well as submitting to regular checks and product audits. Many private sector purchasers operate similar schemes for their suppliers.

2.18 Following the establishment of BSI assessed capability schemes based on the quality systems standard BS 5750 (a fuller description of BS 5750 is contained in Annex B), various sector working parties of NEDC and industry trade associations are starting sectoral quality assurance schemes based on BS 5750. This standard includes the requirement that suppliers establish, document and maintain an effective and economical quality system to ensure and demonstrate that products or services conform to requirements specified by the customer (or if not specified by him, then by the supplier himself). The documented quality system is to include quality management objectives, policies, organisation and procedures to demonstrate compliance with the standard. One such scheme for the fasteners industry, set up with BSI based on BS 5750, is described in our sector studies. These schemes stem from manufacturers' concern to demonstrate that not only does their product meet the specified standards but also that their manufacturing capability is such that quality is high and consistent. Another strong reason for establishing these sector schemes is the manufacturers' desire to reduce their costs of meeting a plethora of separate customer assessment schemes with the hope that, mainly through promotional activities by their trade associations, customers may be persuaded to accept BS 5750 based sector schemes.

Codes of practice

2.19 In addition to the use of standards and approvals schemes, many industry sectors operate codes of practice which govern the design, implementation and use of their products. These codes have no automatic statutory status and may parallel the codes of practice and guidance issued by regulatory bodies. Typical of such a code is the Institution of Electrical Engineers (IEE) Wiring Regulations which cover present practices in electrical installation work. They refer widely to BSI specifications and codes of practice, and have been drawn up in accordance with the International Electrotechnical

Commission's publication on electrical installation in buildings, which has been adopted by CENELEC – the European Committee for Electrotechnical Standardisation – and is therefore available for implementation by national standards bodies.

The legislative background

2.20 About 300 out of the 8,500 British Standards receive some kind of official backing. In some UK regulations, compliance with a British Standard product specification is made a requirement of the regulations, while in others, British Standard measurement and test methods are referred to in regulations which themselves stipulate the performance to be attained. A few regulations incorporate the text of standards. Where every word of a standard becomes part of the law, the standard must be written in legally acceptable language, and this is not normally the case. Reference is usually to a standard of a particular date, and the regulations must be revised when the standard is revised. 'Ambulatory' reference to undated standards is not favoured by Government or Parliament because changes made to the standard through BSI would automatically change the regulation, and this is considered to detract from Parliamentary authority.

2.21 Despite these mechanisms for referring to standards in legislation, the UK unlike many other countries has traditionally made little use of standards and certification in primary legislation or in regulations and, as a result, British industry is not generally used to working within such constraints. The principal areas where standards or certification requirements are used is in the Weights and Measures Act where, as previously mentioned, type approval (certification) and marking of measuring equipment used for trade is required, and under the Consumer Safety Act. Enforcement of these Acts is the responsibility of the Department of Trade. A certain number of standards are directly referred to in regulations to protect the consumer under the Consumer Safety Act, and the classes of product referred to under the Act must conform to the relevant standard. However there is no further requirement that compliance with the standards be independently certified or that the manufacturer's ability to produce to consistent quality is assessed.

2.22 Certain regulations made under the Road Traffic Acts also require compliance with British Standards for products – mainly safety-related – such as seat belts, glass and safety helmets. A further example of the use of British Standards is in the requirements of the Health and Safety at Work Act. The Health and Safety Executive (HSE) makes use of British

Standards in informal and administrative guidance and, more specifically, requires that products such as safety goggles conform to the relevant standard. HSE has so far concentrated its attention and resources on ensuring the safety of equipment in use, rather than ensuring the initial integrity of products (which its Act permits it to do). This balance of attention seems to be shifting slowly towards the latter area through (for example) the formal recognition of more product standards. The Act gives HSE wide powers to recognise independent standards and certification (formally and informally).

2.23 It is clear from the foregoing that only a very small proportion of the equipment produced by British industry is legally required to meet standards. The major requirements are in the field of measuring instruments and safety equipment. However, the legislative picture is changing. The European Community has initiated several moves aimed at harmonisation of standards and approvals and which establish community-wide criteria. To this end, several Directives have been produced under Article 100 of the Treaty of Rome – which aims at the facilitation of trade between member states – in the fields (amongst others) of legal metrology and motor vehicle equipment. Under these Directives, manufacturers can have their product approved in any approved national test laboratory and are then free to market their products in any Community country.

2.24 This growing but still limited legal requirement should not, of course, obscure the fact that a wide range of equipment is produced to stringent standards imposed by purchasers (eg Ministry of Defence) or to meet voluntary approvals requirements. But by their very nature these procurement requirements and voluntary schemes are fragmented and too often carry little weight in overseas markets.

Product liability legislation

2.25 As yet, product liability requirements have had little impact outside the United States. However, the European Community is now preparing a Directive on product liability. Aspects of the proposals have provoked fierce argument among various countries and it is therefore likely to appear in the UK as a 'minimum' Directive which permits member countries to enact their own tougher product liability legislation if they so wish.

2.26 The impact of product liability legislation on manufacturers depends on whether it includes provision for 'state-of-the-art' defences. Where such defences are available, prosecutions of manufacturers under product liability legislation may be countered by proof that the product was designed and manufactured in accordance with the best available technological knowledge, embodied in officially endorsed product specification and system standards. Compliance with standards is, of course, demonstrable through certification and approval. Despite what happens in the UK, it is quite clear that exporters will be obliged to manufacture to the state-of-the-art standards which exist in other countries and will need to demonstrate compliance by having their products tested to these standards in officially-recognised test houses.

3 Industrial resources allocated to standards and regulatory work

3.1 Researching and designing to standards cost a manufacturer money; so does meeting the assessment requirements of a customer or a voluntary capability assessment scheme. Proposals to expand the use of standards and the scope of product certification or capability assessment requirements immediately and quite justifiably prompt manufacturers to question the additional costs incurred and the likely benefits arising. There are fears that the additional costs of meeting standards and improving product quality make the products less competititve in price terms. In this section, we discuss the costs and benefits of compliance with standards, and product and manufacturer assessment schemes.

Availability of data

3.2 We found that there is a lack of hard data available about the additional costs of meeting standards and certification requirements and of the benefits arising. The actual charges for obtaining product approval and certification are available, although international comparisons are difficult because of the different methods of charging by approvals bodies. Less well quantified are manufacturers' own costs of the additional design, development and administration work to meet standards, certification and capability assessment criteria. The BSI has recently published a guide (BS 6143: 1981) entitled 'The determination and use of quality-related costs' to assist manufacturers and provide the framework for assessing quality costs. Nevertheless much anecdotal evidence emerged during the product sector studies and from elsewhere; limited evidence has also been collected by the Department of Trade on the costs of obtaining overseas certification. Even some firms who maintain comprehensive records of their costs found it difficult to quantify the benefits of their outlays on standards, certification and quality procedures.

Resources allocated to standards

3.3 Whilst comprehensive data are not available, there is no doubt that significant technical resources are devoted to ensuring that products are designed to and subsequently meet standards. For the majority of manufacturers, an essential preliminary part of the design process comprises investigation of standards and regulations. The resources allocated to this work may be substantial if the product is to be designed to meet a variety of standards for overseas markets. Many of the larger companies interviewed in the sector studies maintain comprehensive standards libraries and often employ technically well-qualified staff full-time on standards work.

3.4 International marketing requires that standards and regulations are included in a design brief which matches as closely as possible *all* the market requirements. One of the main arguments in favour of standards is that the process of standardisation speeds the work of the designer by providing ranges of standardised components and by simplifying the problems of interfacing components and systems. On the other hand, a designer must familiarise himself with the standards which can aid him in his work and at the detail design stage may have to devote considerable time to researching the necessary standards data.

3.5 In addition to the resources devoted to investigating and designing to standards, manufacturers also devote a significant amount of time to standards-making. BSI estimate that the 30,000 or so members of standards committees devote some £50–100M of voluntary effort each year to the preparation of standards. Much additional time and expense is devoted to representing the UK at international standards meetings, and the work load is increasing.

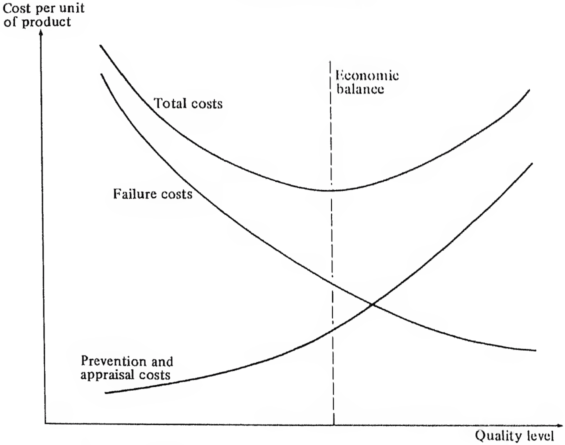
The costs and benefits of quality

3.6 Most analyses include three elements in the consideration of quality: appraisal, prevention, and (most important) the cost of product failure. This approach is adopted by the BSI Guide (BS 6143) mentioned above. The costs of failure, which may be incurred by the manufacturer or by the first or subsequent purchaser, are the costs which arise from failure to reach the quality specified. These costs may include scrap, rectification or other warranty charges. Equally important to the manufacturer, product failure may result in the loss of customers. Appraisal costs are the costs of assessing the quality achieved, and include the costs of internal or independent inspection or certification. Prevention costs are those of any action to investigate, prevent or reduce defects and failures, and obviously include any design or development costs incurred in improving the product. Of the three cost components, prevention costs are probably the most difficult for a manufacturer to determine.

3.7 The costs of appraisal and prevention must be viewed against the benefits of reduced failures. As illustrated in figure 1, the optimum benefit is achieved when an economic balance is obtained between reducing failure costs and increasing prevention and appraisal costs. Either side of this point of economic balance, one cost element outweighs the other and the total benefit decreases.

Figure 1

Quality costs model



Based on BS 6143 : 1981

Costs of certification and approval in perspective

3.8 Surveys have shown that for most manufacturing organisations the costs of appraisal, which include cost of certification, are greatly outweighed by the costs of failure. Some examples are shown in the following table –

Company	Appraisal and prevention costs as % turnover	Costs of failure as % turnover
Metal processing	0.6	10.1
Foundry	3.0	13.2
Motor vehicle assembly	1.6	4.9

Source: derived from Urwick Orr Ltd

While such figures need to be treated with caution, they do indicate that failure costs can be substantial in relation to turnover and that an increase in appraisal and prevention costs by these companies may well be more than repaid by a reduction in failures.

3.9 Certification and approvals schemes are one method of appraising products. But certification costs themselves form only a small part of total appraisal costs, which in turn are very much less than the cost of failure. Thus, in terms of unit cost of the product, certification and approval are economically justifiable.

Direct costs of certification

3.10 Direct costs of certification are easier to quantify and therefore are easily quotable out of perspective. The various certification bodies such as BSI(QAD) operate on a specific – and often published – fee basis. However, distortions and manufacturers' misunderstandings creep in because of the different methods of charging used in the UK and overseas.

3.11 In absolute terms, the costs of certification do not appear high. Typically, testing and certification fees in the UK for an electrical switching device are of the order of £1,000 to £2,000 per annum. Overseas certification fees are in a similar range and, where a licence fee for the certifying mark is payable, it is normally 1 – 1.5 per cent of turnover for the product concerned. BSI(QAD) charge a modest lump sum for the use of their Kitemark and Safety Mark in the UK.

3.12 Where product testing and certification is undertaken overseas to meet the regulatory requirements in overseas markets, costs may be significantly increased by the need to ship sample products for testing, visits by technical staff to the overseas certification body, and possibly the cost of inspection of the manufacturer's UK facility by staff from the overseas testing body. Such costs vary enormously, depending on the complexity of the product and the nature of the test requirements. There is much anecdotal evidence of the high costs of overseas certification, which NEDO have recently tried to quantify. Again however, accurate figuring is difficult because few companies cost the time of their technical and administration staff involved in these activities. As an example, fees of £7–10,000 are quoted for gaining approval in West Germany of items such as motor components. Such sums may be required for each component certified, and design changes to the product usually necessitate recertification.

3.13 There are frequently delays in gaining overseas certification, and the costs of delay can very considerably exceed the direct certification costs. NEDO have reported examples of 5-year delays as a result of which either the manufacturers have given up their attempt at penetrating the overseas market or the products have been rendered out-of-date. Even with shorter delays, there is a loss of export business through the inability to establish a presence in the market at the right time.

3.14 Clearly, the costs of obtaining certification represent a barrier to entering certain markets. However, some help for exporters is available. The Market Entry Guarantee Scheme, which is operated by the British Overseas Trade Board, is designed to help small and medium sized UK firms break into new overseas markets. Under this scheme, funding up to 50 per cent of certain eligible overheads for market entry is available, repayable at a commerical rate of interest through a levy on sales receipts from chosen markets. If sales prove insufficient for repayment over an agreed period, the firm pays a fee. Among eligible costs are those of testing and approval of products to local standards and the costs/fees for patents, trading licences, trade marks etc.

Benefits of certification and approval

3.15 The resources allocated to standards and quality represent a significant burden to manufacturers. For example, in the videotex sector, compliance with quality, reliability and safety criteria is put at 8 per cent of total costs. But this expenditure is undertaken because firms regard the benefits as exceeding this. Certification and approval costs form only a small proportion of quality costs, although they may form a significant hindrance to entry into overseas markets, particularly for small and medium sized companies. Quantification of the management, administrative and technical costs of obtaining certification and approval is difficult, and little hard evidence of the real costs is available. But in the sectors for which figures are available, the scope and need to reduce the costs of product failure by increased attention and expenditure on appraisal and prevention is fully recognised. We see no reason to believe that these industrial sectors are unique in their current appoach to quality.

4 Practices in other countries

4.1 In Section 2, we describe the major institutions and regulatory influences which in the UK bear on the design of manufactured products. We here describe some of the parallel activities in other countries.

4.2 These institutions and influences are present in other trading nations although, as indicated later, they are much more closely integrated in most of them than in the UK. In each country there is a national physical laboratory, run by the Government, as the repository for fundamental measurement standards and the centre of expertise in the science of measurement. There is a national standards body (DIN in West Germany, AFNOR in France, JISC in Japan) which is independent of the Government though partly funded by it, and which enjoys technical and research support from government laboratories at little or no cost. The major national standards bodies hold a protected certification mark (the DIN Gepruft mark, the French NF mark, the JIS mark) which they license for use by domestic manufacturers who have subjected their products to independent certification of compliance with national standards and their production and quality systems to independent scrutiny. The national standards body may operate such certification schemes itself or authorise other organisations of which it approves to do so. In the case of Japan, the licensing of the JIS mark and associated inspections are a Government function.

4.3 In each country also, there are laws and regulations to control the use of technology, in the interests of protecting the environment, the consumer or the worker; for example, nuclear safety regulations, and safety at work regulations. The manner in which such requirements are defined and the extent to which they draw on the codified practical experience embodied in national standards varies considerably from country to country. But in the cases we have examined, the relationship between regulations and standards is much closer than in the UK. Also the means by which compliance with regulations is enforced varies, as does the use of certification schemes in the process. The differences between countries reflect different cultures, legal traditions and administrative practices. We here describe the principal differences in the use made of standards and of certification and approval schemes in France, West Germany, Japan and the United States of America.

France

4.4 Under the Napoleonic Code, the designer and the manufacturer of a product is legally liable for its satisfactory performance for a considerable time after its sale (ten years, for example, in the case of buildings). It is customary to insure against this liability. Insurance companies take an active interest in reducing their risks, and therefore require certified compliance with standards or testing by an independent approval body as a condition of insurance. A complex structure of approvals bodies has grown up, most notably in the construction field. Building products must carry an 'avis technique' (formerly agrement certificate) before insurance companies will cover them. Innovative products are assessed by 'Technical Control Offices', which arrange for testing and issuing new 'avis techniques'.

4.5 Approval authorities include government departments, AFNOR, and independent bodies. There are 52 'NF-Mark' certification schemes run by AFNOR, covering consumer goods, industrial equipment and building products and over 30 other approval bodies covering wood products, pressure vessels, lifting equipment and many other items.

4.6 Product approval may also be required by regulation, as with pressure vessels. In such cases, tests must be carried out in France under the surveillance of an inspector, who may reject the vessel at his discretion if dissatisfied either with the vessel itself or its manufacturing or materials history. In some sectors, regulatory requirements have been loosely worded or changed with very little notice, and while goods were in transit. Sample products sent for testing and approval in France have been turned back by customs officials because they did not carry the approval mark being applied for. In other sectors, where the technical requirements have been clearly defined, there have been fewer difficulties and delays.

West Germany

4.7 Germany has a long tradition of Government intervention in industrial matters, in the interests of health and safety. In 1884, industrial insurance law was passed – the first in the world – requiring employers to insure their workers against accidents. As in France, the insurance industry so as to reduce claims became involved in the prevention of accidents; since 1911 in Germany, the Berufsgenossenschaften ('professional societies'), organised on a sectoral basis and numbering 36 in total, have exercised delegated authority under the law to ensure the employers comply with their duties.

4.8 In 1968, the Law on Technical Equipment was passed. It established a broad framework embracing practically all manufactured or imported goods. The central provision is that 'the safety of technical equipment shall be ensured... by observance of the recognised rules of techology'. In practice the Courts recognise DIN standards and codes of practice drawn up by professional engineering institutions as embodying the rules of technology. The best defence against safety or product liability litigation is therefore to have products certified as complying with DIN standards.

4.9 Codes of design drawn up by the professional institutions are widely adopted and are frequently the precursors of DIN standards. The institutions have a close relationship with industrial management – firms are among their corporate members – and the codes of design therefore reflect the technical and commercial interests of West German industry. The mechanical engineering institution (VDI) for example has 500 specialist committees, 70,000 individual members and 2,000 corporate members through which the codes can be promulgated.

4.10 In addition to the Berufsgenossenschaften, there are several other organisations and groups, including the national physical laboratory, with recognised competence in testing and assessment. The products covered include electrical equipment, construction products, lifting equipment, pressure vessels and gas equipment.

4.11 The DIN protected mark was registered in 1920, soon after the DIN was formed. It signified a manufacturer's claim that his product complies with DIN standards. In 1972 the 'DIN Gepruft' mark was introduced, for use with products whose compliance with standards is independently certified (similar to the BSI Kitemark schemes). In 1977, the 'GS' Safety Symbol was introduced for use by approval bodies licensed by the Government to carry out safety testing. If, in the course of safety testing, the approval body finds that the relevant DIN standards are inadequate, then it has a duty to report this to the DIN so that the standard may be modified. In this way there is a constant feedback from the testing and approvals process into standards-making.

4.12 In practice therefore the West German market requires that manufactured products comply with DIN standards especially where safety is at issue, and be certified as complying by a Government-approved West German test house. This combination, with the relatively stringent technical requirements embodied in DIN standards, favours high quality domestic products over low quality imports and the effect is amplified by the tendency of West German manufacturers to regard even the requirements of DIN standards as a minimum.

Japan

4.13 Whereas in France and Germany the development of regulations and approval schemes has been aimed at safety and technology control in the home market, in Japan the main policy aim in recent years has been to improve the quality of exported products. To that end, an Export Inspection Law was passed in 1957 and regulations under this law now designate 194 products and 37 inspection agencies. A designated product may not be exported without approval from a designated inspection agency.

4.14 One of the most effective schemes has been that operated by the Japan Camera Inspection Institute (JCII). The JCII was established in 1954 and is now an international centre of excellence in photographic equipment. It is self-financing from test fees, has a staff of about 120 and possesses major items of test equipment which few manufacturers could justify on their own. Its purpose is to inspect and approve cameras for export.

4.15 The starting point for JCII's work is the ISO Standards for photographic equipment. JCII at present holds the ISO Secretariat for the technical committee which deals with photography. The JCII carries out laboratory tests on the reliability and durability of the camera, the optical characteristics of the lens, the effects of vibration, dust, temperature extremes and so on. If a sample camera looks like failing the tests, then the manufacturer will be informed privately, and design staff will liaise closely with JCII staff to rectify the problem.

4.16 Under the Industrial Standardisation Law of 1949, the Ministry of International Trade and Industry (MITI) may designate products as falling under the JIS marking system. JIS is their equivalent to our British Standards Institution for writing standards, although the sale and promotion of standards is the job of a separate private sector institution, the JSA. The JIS Committee will recommend to MITI that it should endorse certain JIS standards. Manufacturers who wish to use the JIS Mark must then apply to the Minister for a licence to do so. Before granting the licence, MITI will examine their manufacturing and quality control systems and require third party testing of the product by an accredited laboratory.

4.17 The scheme is largely voluntary. The Government controls the use of the JIS Mark but the standards are written by JIS and adopted by MITI on the recommendation of JIS. Approval of products and assessment of a manufacturer's quality capability are done by independent test houses. Only the accreditation of test laboratories is carried out directly by MITI. There is no prohibition of unmarked products and no compulsion for manufacturers to belong to the JIS marking scheme.

4.18 The Japanese schemes have been in operation for some years and it is now common for manufacturers' own internal standards and quality assurance practices to exceed considerably those set under the Export Inspection Law. The national standards may therefore act as a safety net, which most major manufacturers no longer need, to prevent the export of low quality goods. The drive for high quality comes from the firms themselves.

United States

4.19 Compared with France, West Germany and Japan, standards-making in the United States is fragmented. Over 400 organisations produce standards of national significance. The major contributors like the American Society for Testing Materials (ASTM), the American Society of Mechanical Engineers (ASME), the Society of Automotive Engineers (SAE) and the American Petroleum Institute (API) as well as many other organisations, all produce standards which have gained international recognition. Formal links with the international standards bodies, ISO and IEC, are made through the American National Standards Institute (ANSI) which however produces virtually no standards in its own right. It applies national accreditation to documents prepared by many other organisations and which may have been current for some time before ANSI is asked to recognise them as American National Standards. Nevertheless a substantial proportion of (for example) ASTM standards have not been adopted by ANSI even though they are widely used.

4.20 Certification and approvals in the United States reflect the two-tier structure of Federal and State legislation. Compared with the centralised arrangements in European countries and Japan, there are relatively few nationally-applied systems of certification and approval. The Federal Communications Commission's regulations controlling radio and television interference are universally applied in all the States of the Union. At the other end of the scale, there is no single code for the whole country in building and construction, and 15,000 local authorities each make their own building regulations. In other areas of activity, there are commonly both national and local requirements, and a profusion of independent testing and approval laboratories.

4.21 On a nationwide basis, Underwriters Laboratories Inc (UL) – a non-profit independent organisation – operates certification schemes to its own standards, about half of which have been adopted by ANSI. The Factory Mutual Research Corporation (FM) also operates approvals schemes for equipment, materials and services in the electrotechnical and construction fields which bear principally upon safety from fire. FM and other similar organisations work to their own standards or those produced by other organisations. Both FM and UL are linked with the insurance industry whose policies frequently require that approved products are used in buildings and equipment.

4.22 In the construction field, the many and disparate local requirements have been centralised to some degree by the Building Officials Conference of America (BOCA). In addition to establishing four major Model Building Codes to guide local authorities it has dealt with the acceptance of new Building Codes.

4.23 United States manufacturers expect to demonstrate compliance with a variety of national and local requirements – especially those concerned with safety – as well as to accommodate a wide range of climatic conditions in which their products might be used in the United States, from arctic Alaska to arid New Mexico. The insurance requirements for certificated products in the United States appear in general to have contributed to the sustained competitiveness of American products in overseas markets, particularly since the United States home market is very large. As an additional reinforcing factor, the American labour unions will not allow their members to work with equipment which has not been approved by the appropriate authority which may well involve independent certification.

International co-operation

4.24 We have concentrated on examples of national certification and approval schemes and their links, on the one hand with national technical law, and on the other with national standards bodies and test laboratories, including the various national physical laboratories. Integration of these activities is much closer in West Germany and Japan than in the UK.

4.25 The links between national bodies are also important. There is a strong tradition of international collaboration on the preparation of standards through such bodies as the ISO, the IEC and the ECE. Similarly, in the scientific community there is a strong tradition of international collaboration and exchange of information. International co-operation on measurement standards and mutual recognition of foreign test laboratories are part of this co-operative effort. By contrast, there are few international linkages and examples of reciprocity between national certification schemes and between regulatory processes.

5 Summary of submissions

5.1 The major UK institutions and bodies concerned with design, marketing, standards and regulations were invited to give evidence to the Working Group. The majority responded with written submissions, and some were invited to supplement their submission with oral evidence to the Working Group or to the Secretariat. Certain themes were common to a number of the submissions and these, together with other important points, are summarised in this section. A list of those who made submissions is at Annex D.

The British culture and attitudes

5.2 The British cultural background was felt to inhibit efforts to improve performance and competitiveness in design for international markets. In particular the social and educational system had hampered appreciation of the importance of the characteristics of our products. Thus manufacturing industry was felt to operate in a climate unfavourable to enterprise where the legislative and regulatory functions were not co-ordinated. Metrication was cited as one example amongst many: abolition of the Metrication Board and the prohibition of differential pricing had left industry with increased design and manufacturing costs from operating a dual imperial/metric system.

5.3 There was a different basic attitude to regulation here and in other major industrialised countries of Europe. A European customer saw demonstrated compliance with standards as an assurance of a product's integrity; the UK customer assumed the product was acceptable unless it was shown otherwise in the Courts. As an example, for pressure vessels, some 70 countries had national standards, legal requirements or regulations which must be met by imported plant. In contrast, the UK had little in the way of prohibitive requirements beyond those specified by the purchaser.

Design

5.4 Several submissions expressed the view that good design practice could improve international competitiveness and it was regrettable that the Feilden, Moulton and Corfield reports on design had made relatively little impact. Product design dictated almost the whole cost of manufacturing operations and the majority of factors controlling product price and value. It offered a manufacturer one of the best ways of differentiating his product from those of a competitor. For example, in textile machinery, only 4 per cent of British companies in a 1977 survey attributed their 'buy foreign' decisions to price. Two-thirds claimed that their decisions were based on the machinery's superior 'performance' or 'quality'. However, where price was important, better design could make a product cheaper, perhaps through using fewer and standard parts. The costs involved had to be set against the risks of doing nothing. Standards helped in producing sound designs and could contribute to a reputation for quality, but product competitiveness in international markets should never be thought of as solely dependent upon the existence of good national standards.

Market requirements

5.5 It was not generally easy for manufacturers to differentiate goods for the home and overseas markets. The extra costs of design and administrative effort to make products meet requirements which were peculiar to the UK (especially regulations and for public sector purchasers) might price products out of overseas markets. In some sectors UK regulations differed markedly from those of other countries which themselves differed. In some submissions, it was felt that countries should only enact regulations which were explicit as to scope and field of action, were detailed as to the manner of application, and were coupled with quick and inexpensive approvals procedures. Vagueness in requirements and the difficulties of obtaining information posed problems which could be costly to manufacturers. It was not so much overseas regulations that impeded acceptance of UK products as the long-winded and expensive approvals procedures which were often required.

5.6 It was claimed that, in the heavy process industries, the cost penalties of designing to meet UK requirements on safety, pollution and aesthetics – mainly arising from local planning requirements – were beginning to make the UK an unattractive site for investment compared with southern Europe and other locations. Risk analysis could establish the cost of various levels of safety and environmental impact, but informed debate was needed as to the *acceptable* standards in the health, safety and environmental fields. With no formalised or documented standards for safety and aesthetics, every local planning enquiry started from scratch. HSE was seen to be a tougher regulatory agency than others in Europe, and this could also militate against manufacturing investment in the UK.

5.7 International harmonisation of standards and regulations would bring considerable benefits to trade. There should be strong UK input to the harmonisation of international and European standards, with full Government support. The European Commission's current proposals for prior notification of regulatory and other changes would help only if it was sensibly applied and scrupulously observed.

British Standards and standards-making

5.8 Most respondents felt that there should be greater use of and higher status for British Standards (and Agrement certificates). It was difficult and unfair to generalise about the quality of British Standards. Many, while affecting design, did not necessarily influence those qualities on which market success depended. In technical terms some British Standards were markedly superior to foreign standards in worldwide use (for example BS 5500 Unfired Pressure Vessels). Some standards might have been better written and presented, but that was also true of DIN, ANSI etc. British Standards-making was however perceived as slower, and British Standard products less accepted overseas, than for example DIN. There was a need for greater consideration of market priorities in BSI priority-setting and technical committee work. BSI presently lacked the resources to prepare and publish all the standards industry would like, and to develop the standards needed to keep pace with new technologies. Special interim funding for BSI was needed to deal with this. The effort which industry put into its own standards and assessments would be better devoted to British Standards. Providing financial recompense for services of representatives on standards committees would help to get more effective and better calibre representation from the interests concerned.

5.9 BSI committee members voluntarily contributed £50–100M in resources to standards work in committee – this in addition to much work in trade associations and elsewhere on standards and standards-related work. Withdrawal of BOTB support (£400,000 per annum), as presently proposed, for the travel expenses of delegation leaders would severely damage the British presence and advocacy in international meetings. It was estimated that 75 per cent of BSI project effort was related to international and European work.

5.10 Following West German practice, much more use could be made of codes of practice and guides established by reputable bodies, such as the Engineering Institutions, prior to a British Standard being adopted. However it was recognised that existing codes of practice and industry standards might not be suitable as a basis for new British Standards. Other outside support for BSI standards-making was required. The Department of Industry was moving towards support, through its Requirements Boards, of practical work required for the preparation of British Standards including R and D, the design and construction of new test equipment or evaluation of new test methods, preparation of draft standards in approved format and provision of specialist technical information and reviews. To be supported by a Requirements Board, R and D or technology must be involved (not simply the acquisition of non-technical data), all parties including trade associations should agree that the work was needed, and there should be generally at least a 50 per cent industrial contribution towards the cost (although much of this could be in kind).

5.11 Great dissatisfaction was expressed with policing of false claims of compliance with British Standards under the Trades Descriptions Act. Whilst any person – aggrieved or not – has a common law right to take offenders to Court, the cost, effort and the negligible penalties deterred them from such litigation. The GLC were quoted as saying that as high a proportion as 50 per cent of construction products which were claimed to comply with British Standards did not do so. Competitive tendering and preference for the lowest tender was likely to produce a very high probability of products being below standard specification. These problems brought standards into disrepute and helped perpetuate a perceived low status of British Standards.

5.12 Looking to the future, standards might have an even greater role to play. It was predicted that in the next few years there would be a considerable extension of all types of standards arising from EC regulations, including health and safety and consumer protection. Another projection was that, in the early 1990s, one third of the work in the development of standards would be performed by computer. By the mid 1990s, one quarter of all machined products would be designed by computer and interactive graphics would be operating in companies of less than 1,000 employees.

Regulations

5.13 There was felt to be fragmentation of responsibility for generating regulations in the UK with inconsistency in the development and application of policies. To facilitate enterprise, it was suggested that some regulatory agencies should have more input from the public and small businesses. There were also difficulties identified arising from the UK legal system because binding interpretation of regulations, such as type approval procedures to ensure compliance, were not available and the Courts would decide only after a transgression or product failure.

5.14 Considerable benefits arose from international harmonisation of regulations and type approval procedures. The impact of international regulations, on for example commercial vehicles, had been to raise the standards of design and increase the complexity and sophistication of the product. But because directives were accepted throughout the European Community, international regulation also reduced the number of special specifications required and enlarged the market accordingly.

5.15 The current variety of techniques in the UK for reference to standards in legislation and regulation was complicated, inefficient and ineffective and imposed an unneccesary burden on industry and the Government administrative machine. This was particularly true where standards, which were not normally written in legally acceptable language, had to be re-written for incorporation in legislation. The Government must ensure effective departmental nominations to BSI committees at policy and technical level so that the total standards effort was attuned to national trading and industrial policies. (Existing guidelines to Government representatives were excellent and could help *if they were followed.*) There would be great advantage to industry in establishing a simplified across-the-board relationship between Britain's published national standards and the legislative process.

5.16 There were similarities between the Health and Safety at Work Act (HSWA) and the German Technical Equipment Safety Law in regard to the recognition of informal codes of practice etc. Over 100 standards were referred to in non-statutory guidance material produced by HSE, but few were formally recognised in approved codes of practice. The Robens Report on Health and Safety at Work, on which HSWA was largely based, contained the principle that voluntary codes of practice should be recognised by regulatory authorities by *administrative* means. The Act itself did not give recognition to the large number of voluntary codes which already existed at the time of its enactment in 1975 although it did provide a mechanism for doing so. However, the Health and Safety Commission and Executive have subsequently declined to recognise some of the codes. Even where formal recognition has been forthcoming, a further layer of public consultation is required through HSE. This duplicated BSI's own consensus procedures, diverting public funds and delaying the availability to the designer and industry at large of a publicly-available means of meeting legal requirements under the HSWA. Industry (not least through its representation in the Health and Safety Commission's consultative machinery) was felt to be ambivalent in its attitude to the benefits of various health and safety control philosophies and their economic implications.

Certification and approval

5.17 It was widely felt that mutual recognition of national testing and certification schemes with overseas countries would help entry of UK products into overseas markets. The establishment of the NATLAS scheme of testing laboratories was a good start in this respect. There was a growing acceptance in international standards bodies of the need for such mutual recognition. However the UK had relatively few approval schemes and even fewer that were eligible for mutual recognition.

5.18 In the construction industry, the strictest overseas requirement was in West Germany where products had to conform to a standard or be subject to 'Zulassung' technical assessment. Test work had to be done in State-approved laboratories with quality surveillance of production by a nationally-approved scheme. West Germany had successfully marketed its nationally-accredited test houses and quality assurance schemes thereby getting a preferential acceptance of its own products. The UK had been severely handicapped through not having a test house accreditation scheme (now beginning to be remedied by NATLAS), few quality assurance schemes and by the low status of British Standards and Agrement certificates.

5.19 In some submissions it was asserted that there was no evidence that the BSI Kitemark carried any weight abroad or appeared on many goods sold overseas. The wool mark insignia of the International Wool Secretariat (used as a promotional aid) was more in evidence in continental shops. Some 60 per cent of products submitted for Kitemarking did not comply with the underlying British Standard, or manufacturers' quality assurance was inadequate. On average, a manufacturer only secured a Kitemark licence at the second attempt.

5.20 In the absence of reciprocal testing arrangements with overseas countries the Market Entry Guarantee Scheme sponsored by the Department of Trade had proved useful. However, this support was not widely known and could usefully be extended to cover currently non-eligible overseas testing costs.

Quality assurance and capability assessment

5.21 Quality assurance and capability assessment schemes had grown in popularity over the past few years. They originated in the Ministry of Defence schemes, and many large purchasers operated their own supplier capability assessment schemes. However, there was criticism of the plethora of such separate schemes and the expense of meeting them. It was hoped that voluntary sector schemes based on BS 5750 would become more widespread. BS 5750 based capability assessment schemes needed to be effectively promoted as reducing purchasers' assessments of manufacturer capability and giving manufacturers detailed guidance on more soundly-based quality assurance systems. A good example of such a voluntary scheme was cited as that for unfired pressure vessels. The Pressure Vessel Quality Assurance Board, serviced by the Institution of Mechanical Engineers, registered firms of assessed capability (to BS 5750) who designed and manufactured pressure vessels in accordance with BS 5500 'Unfired Fusion-Welded Pressure Vessels'. The scheme had the blessing of HSE but no statutory backing. In a contrasting area, installers of ureaformaldehyde cavity wall insulation were required, under the Building Regulations, to be registered by BSI under the appropriate assessed capability scheme.

5.22 Defence standards in the 05–20 series and other defence quality assurance techniques, such as the analysis of failure modes inherent in designs, could provide even stricter disciplines leading to higher product quality (but at commensurately higher cost). These could be promoted as follow-ups to the BS 5750 schemes if the higher standards were required, particularly for safety-critical equipment.

5.23 The acceptance of capability assessment schemes based on BS 5750 was felt to be hindered by the poor calibre of purchasing management in the UK, with many people in the purchasing function having little or no technical training. The public sector substantially bought British products but was felt not to use its purchasing power in a selective way. For example, many local authorities had no established purchasing departments and buying was split between various functions with consequent penalties in standardisation, quality and value for money.

Non-tariff barriers to trade

5.24 It was said that not all the problems which industry describes as non-tariff barriers could be strictly defined as such in the sense of discrimination by foreign governments or authorities in breach of GATT or EC agreements. Some reflected UK companies' lack of information on foreign requirements, or the cost of meeting them. NEDO had assembled nearly 200 cases of these kinds which were seen by industry as representing effective deterrents to export.

5.25 Some cases were of specific discrimination by overseas governments or authorities in favour of their local manufacturers, which could be in breach of international agreements. These could be tackled by the Department of Trade in direct negotiation with the countries concerned, although it was often very hard to get evidence of a kind sufficiently rigorous to substantiate such cases in inter-governmental negotiations (which did not mean that the practices did not take place), and for various reasons companies quite often did not pursue these cases. There were still however complaints that government agencies did not support firms adequately in this area, and the lack of confidence was felt to be disturbing.

5.26 The remaining cases involved mainly technical market requirements and were not in breach of international agreements. These difficulties included –

- identifying and interpreting overseas requirements
- the cost and delay of meeting overseas certification requirements
- the lack of UK standards, quality assurance systems and certification schemes which could be accepted overseas
- a hard core of discriminatory practices on the part of overseas regulatory and certification bodies eg delays and administrative requirements

Many of these difficulties could be reduced or eliminated by the mutual recognition of certification and testing arrangements by the UK and countries overseas.

Education and training

5.27 We heard that designers in many firms were unaware of overseas requirements and were unable to carry them out with the necessary precision. This was considered as pointing to a fundamental and disturbing deficiency in their training. There was little formal training available at any level about awareness and implications of standards and regulations here and abroad. Engineering students at university were usually not made aware of the constraints imposed by standards and regulations. In particular, there was a need to improve the interface between education and the practical application of design and manufacture eg the practical implications for production of determining tolerances.

5.28 The clearest need was for a substantial increase in in-career training for designers and engineers, not only in their specialist skills, but also in the development and use of standards and regulations, and their effects on design. This view accorded with that put forward by the Finniston Report. The professional institutions could, and some already did, play an important role in this process, but much more work needed to be done. It was felt that this might be an area to which the Engineering Council could devote effort.

Dissemination of information

5.29 Many of the problems that exporters encountered in overseas markets stemmed from lack of information about regulations and other market requirements. Smaller firms found it more difficult than larger ones to keep themselves informed. There should be a comprehensive English index available of overseas requirements, and the Export Intelligence Service of the Department of Trade could help by giving subscribers advance notice of changes in foreign regulations. Exporters found that the major embassies abroad responded well to enquiries, but generally the diplomatic posts in the smaller, less developed countries lacked the specialist expertise to gather information at the required level of detail to satisfy all queries.

5.30 The BSI Technical Help to Exporters service sponsored by the British Overseas Trade Board was good but passive, and the availability of information on overseas requirements needed to be actively publicised. THE was greatly under-used and non-member firms were put off when they found that it charged for its services. The cost of translation was high (as was the cost of some British Standards) especially for smaller firms. In view of this, THE might be asked to review the structure of its charges.

5.31 There was also the problem of the lack of knowledge, and consequent poor status, of British Standards. There should be more publicity of the existence of certain British Standards and they should be widely available through a variety of media. A single source of information on UK national standards and regulations would be helpful. BSI was already moving towards the establishment of a data-bank which might be available to firms on a pay-as- you-go basis.

6 Product sector studies

6.1 To assess the ways in which companies identify and comply with differing national requirements affecting their products, we undertook four studies of product sectors in the UK –

electrical and electronic components
videotex systems
industrial fasteners
metal and plastic framed windows

Each study was conducted by means of structured interviews, supplemented by correspondence, with the relevant trade associations and within each sector about six firms, British-owned and multinational, generally including the market leaders. Certain themes were common to the first three sectors, notably in the identification of overseas requirements. We summarise here the main points emerging from the product sector studies. The study reports in full are contained in Annex C.

Overseas requirements

6.2 For electrical and electronic components, videotex systems and industrial fasteners, keeping track of overseas standards was considered to be a part of market research, and ensuring compliance a line management function. One of the firms interviewed had, in addition, highly developed, documented procedures for ensuring that decisions were made about meeting various overseas requirements at milestones in the design and development process. Other smaller firms do this in a less structured way, frequently through a nominated senior staff member working with a relevant trade association and with professional contacts overseas. Most firms – especially the larger ones – had at least one professional full-time, reporting to high levels of management, working on aspects of standards, quality and regulations.

6.3 The firms interviewed generally have little difficulty in obtaining information about overseas standards and specifications. Nevertheless, obtaining English versions of standards published only in the original language was tedious, expensive and resulted in important subtleties being lost in translation.

6.4 The response of window manufacturers to these questions was different from the other three sectors. This was mainly because of the special characteristics of their export markets. Exports are primarily to countries having a familiarity with British Standards, and therefore tracking overseas requirements is not a significant part of marketing. Indeed, an invitation to tender expressed in DIN standards was likely to evoke a response in BS. Overseas trade is also limited by the very different design and performance requirements applying in other countries.

International standards

6.5 International standards reflect the consensus reached in national standards-making, and influence the design of products intended for the markets of those countries which adopt the standard. If a country can influence international standards, it may be able to condition overseas markets in its favour. Such an example was reported in the fasteners sector, where West Germany makes a strong and technically well-supported input to ISO, and thereby to British Standards which (in the fasteners field) are currently driven by ISO requirements. British firms may therefore find themselves following, rather than guiding, market requirements.

6.6 The interaction of standards and markets is even stronger in the videotex sector where – because separate systems must be compatible – one or two standards are likely to dominate worldwide. The UK has a major manufacturing commitment to its viewdata and teletext standards, and has gone a long way to making these *de facto* European (if not world) standards. It is therefore vital that the UK succeeds in getting its standards formally adopted internationally, to maintain and strengthen its base for future design and investment. To this end, UK representation on international standards bodies must be commercially well briefed as well as technically competent. Additional inter-governmental contact can help promote UK interests.

6.7 Even though underlying standards may be harmonised internationally (eg electrical safety) national regulations and their interpretation may give rise to variants in practice which affect British products in overseas markets.

6.8 Specification standards in the sectors studied were considered to best reflect the state of the art for mature products, such as fasteners and passive electrical components, and are widely used. For faster developing or newer products such as semiconductors and aluminium windows, standards tended to be rather inert and, although offering a guide to a reasonable product or a very minimum level of safety or performance, they were frequently surpassed by manufacturers' designs.

6.9 Manufacturers' trade associations played a major role in the four sectors, although the single strong federations in the components, videotex and fasteners areas contrasted with the several associations dealing with windows. User input to standards-making was frequently weak. There was criticism that public sector purchasers tended to set their own parochial standards rather than seeking to have their own requirements included in British Standards. In the windows sector, some users were clearly unaware of the role of standards and the wider implications of their purchasing and specifications. In addition, the interests of builders and architects tended to favour (respectively) low grade domestic and high grade foreign products.

6.10 In the windows sector, standards for performance tended to the lowest common denominator – the timber window frame – much to the chagrin of metal and plastic frame manufacturers. This criticism was also levelled at certain of the ISO standards in the fasteners sector. More generally, it is a matter of judgement which aspects of performance should be embodied in standards (or regulations) and which left to the individual customers. Giving customers a wide choice through their individual specifications imposes diseconomies of scale on manufacturers and some standardisation of purchaser requirements is to be preferred.

6.11 In the safety field, however, manufacturers need assurance as to what is needed to comply with the law. Detailed technical regulations frequently do not use the common terminology of the industry (and designers) while those which set objectives need to be supplemented by guidance on how the objectives might be met. The obvious and appropriate solution seems to be that compliance with (up-to-date and adequate) standards be deemed to satisfy the law, although the machinery by which this is achieved is unsatisfactory at present.

Regulations

6.12 It is important that innovation should not be hindered by regulations. The Building Regulations refer back to British Standards which manufacturers regularly surpass, and innovation is thereby hindered. The Agrement system permits certification that innovative products comply with Building Regulations, but the certificates themselves have no legal status – as is also the case for BEAB and BASEEFA approvals. That Building Regulations apply only to windows fitted at the time of construction compounds the preferences of builders to minimise first cost, regardless of subsequent lifetime costs. When coupled with European requirements for high grade, high quality windows, the disincentive to British exports is considerable.

6.13 More generally, UK regulation which is out of step with European Community legal requirements may disadvantage British manufacturers who thereby have to meet additional parochial UK requirements. The UK may also lay itself open to legal action in the European Court if it fails to implement EC Directives without good cause.

6.14 The processes by which regulations are made often appear obscure and perverse to manufacturers. The inconsistency in approach between the Consumer Protection Act and the Health and Safety at Work Act has already been mentioned in this report.

Quality assurance

6.15 Quality assurance techniques are well integrated into company practices. Of the companies interviewed all employed quality assurance and/or inspection staff, often with the Quality Manager reporting directly to the Managing Director. Methods ranged from simple inspection procedures to formally-based capability assessment schemes. Respondents felt that emphasis on quality assurance was likely to increase in the future, partly as a result of product liability legislation, and will require additional company resources.

6.16 Most of the companies interviewed were devoting considerable resources to standards work and quality assurance. Estimates of the costs involved ranged as high as 8 per cent of total costs in the videotex sector. Most felt that this was money well spent, bringing considerable marketing benefits, but there were also complaints of the burden imposed by the need to meet a plethora of separate customer schemes for assessing the capability of suppliers.

Certification and approval

6.17 Certification to safety standards is a common customer (or insurance) requirement for electrical products in the UK. Certification bodies often felt it necessary to go beyond the British Standards concerned to satisfy themselves of a product's safety. These extra requirements, although they become known to manufacturers, are not always fed back into standards-making, so that standards tend to remain deficient.

6.18 Certification from overseas bodies is frequently needed by British manufacturers when selling products or offering them for sale abroad (eg at a trade fair). Testing has to be done abroad causing extra expense, delay and inconvenience. Reciprocal recognition of UK and foreign test houses would ease the burden considerably, as would mutual recognition of national certification and approvals schemes.

6.19 Overseas certification requirements are not mirrored in the UK. For example, a British manufacturer's fastening machine must be tested and receive the GS safety mark before sale in Germany, whereas a foreign machine can be imported and used in this country provided it meets the Health and Safety at Work Act requirements of safety in use (as well as the HSWA requirement of initial integrity, mentioned in Section 2 of this report), but without testing or certification.

Quality

6.20 Standards for quality management, such as BS 5750 and the 05–20 series of Defence Standards, were widely felt to be beneficial in improving the quality of products and reducing the burden of multiple assessment by purchasers. The UK is felt to have a lead in applying quality management techniques, particularly in the fasteners and electronic components sectors. Attention should be paid to practical constraints to wider application of quality management schemes, such as a shortage of appropriately qualified assessment staff. However, it was widely felt that major customers, particularly in the public sector and motor industry, needed further encouragement to use common assessment schemes for their suppliers.

6.21 The electronic components sector also provides an example of the benefits of close supplier-purchaser liaison in improving product quality. Close technical co-operation between component suppliers and TV manufacturers identified mismatches between purchaser specification and product performance; deficiencies in component manufacture; and faults caused during TV set assembly. The resulting attack on all these fronts has enabled components to be produced with failure rates as low or lower than Japanese competitors.

Product liability

6.22 Responses from all four sectors revealed concern about the implications of the proposed product liability legislation. It was pointed out that the existence of a well based quality assurance scheme already allowed manufacturers to negotiate lower insurance premiums. Compliance with reputable certification or approvals schemes may well provide satisfactory prima facie defence under future product liability legislation.

Education and training

6.23 Detailed training of engineering and marketing staff about the effect of standards and regulations on the design of products was felt best incorporated in on-the-job training. This had to be a fundamental part of the company management culture. Only in this way could standards and regulations be fully considered and absorbed into the real life context of firms' commercial activities. Although the awareness that standards and regulations did affect design could be taught to effect in university courses, it was felt that tuition about eg quality management schemes could be counter-productive unless examples used were based on real life.

7 Conclusions and recommendations

The framework for competitive product design

7.1 All the factors bearing on the competitiveness of a product are affected, and some are determined, by the initial design. To obtain well-designed products several elements are needed, including: an awareness by firms of the importance of design; creative and competent designers; a thorough understanding of the influence of technology on products and processes; and close attention to customer requirements as embodied in specifications.

7.2 It is essential that the specification or brief covers all the relevant attributes of a product and reflects the relative importance to be attached to them. Furthermore, the market sector to which a product is directed, the precise market share to be obtained, the methods of sale and distribution, and the pricing relative to competition must all be known before design is started. Throughout the period of design and development, any deviations from the original specification must either be corrected or be incorporated in a modified specification by a positive decision. Much practical experience is codified in national standards. For this reason the attitudes and practices of firms and institutions which bear upon standards and regulations closely affect the design and competitiveness of products for home and export markets. The positive role which standards, regulation, certification and approvals can play in national economies is widely appreciated in West Germany and Japan, but attitudes in UK industry and Government are more equivocal.

7.3 In this section we present our conclusions and recommendations about these factors in relation to British products under the headings of information, quality, product certification and approval, accreditation, regulations and their making, British Standards and standards-making, education and training, and co-ordination. We make a number of principal recommendations and others which stem from and support them.

Information

7.4 Many manufacturers already know that it is important to obtain sound information about their markets, especially where product liability legislation applies. This needs to be done at an early stage in design. If it is not, then the cost of re-design to meet unanticipated requirements can far exceed that of initial design to meet international markets. This point also applies to home markets. The key link is the need for a comprehensive understanding and specification of market needs.

7.5 Major firms have their own sources of information about overseas market requirements through foreign subsidiaries or representatives although, even for the largest firms, obtaining English translations of foreign documents can be difficult and subtleties of interpretation can easily be lost in translation. Smaller firms, on the other hand, may need help and guidance on overseas requirements. Such help is available from Technical Help to Exporters (THE). However, THE is under-utilised and firms who are not subscribers are deterred from using its services because of the cost, despite the grant which THE receives from the Department of Trade (DOT).

> **We therefore recommend** that DOT, in conjunction with the British Standards Institution (BSI), make THE's services more widely known. **We also recommend** that the Department of Industry (DOI), as part of its support for small firms generally, investigate ways to make access to overseas market information less costly for small firms.

For the benefit of UK users, there would be advantage in having a single data base for information on standards, regulations and certification schemes applying to both the UK and overseas countries.

> **We therefore recommend** that the Department of Trade explore with the BSI the possibility of establishing a single data base for information on standards, regulations and certification and approvals schemes applying to both the UK and overseas countries.

Aside from the benefits this would bring to manufacturers, this could be an impressive demonstration of information technology. DOI should provide financial support for its establishment and initial operation.

7.6 The earlier ACARD report on Computer Aided Design and Manufacture pointed out the benefits which CAD can bring either on its own or when linked to computer-aided manufacture. A natural development in CAD systems is to incorporate relevant standards and regulatory requirements into CAD programmes, so that designers are made aware of them as part of the design process.

> **We recommend** that the DOI encourage incorporation of relevant standards and regulatory requirements into CAD programmes through awareness schemes and the provision of funds for the development of design packages.

Quality management systems for companies

7.7 Although they do not influence the design of the product itself, quality management systems, ensuring consistency and accuracy in production, have long been essential in the defence and aerospace sectors. They are now being applied more widely through the manufacturing sector generally, because of the benefits they bring in improved product quality. They are part of good manufacturing practice, and indispensible to manufacturing operations spread over several countries. Schemes based on BS 5750, the British Standard for Quality Systems, and on the Defence Standards for Quality Management (as described in Annex B) bring significant benefits to manufacturers in reducing the costs of failure to meet product specifications. We welcome the initiative of the industrial fasteners sector in establishing with BSI a voluntary scheme for quality management based on BS 5750. It is essential that many other such schemes be established, to ensure and demonstrate that the achievement of consistently high quality is part of British manufacturing culture.

7.8 Out of some 90,000 manufacturing companies in the UK, ten thousand or so have been assessed under various schemes operated by purchasers in the public sector, and probably as many again by the private sector. These assessments are done for varied purposes and require the observance of many different procedures. Since the introduction of national standard BS 5750 in 1979, some 270 firms have been assessed by BSI alone and a further 500 are reportedly interested at present in BSI registration. While this is a good start, there is clearly scope for further rationalisation and consistency of procedures, to reduce the cost to purchasers of operating their own assessment schemes and the cost to suppliers of multiple assessments.

> ***A principal recommendation*** **is that the Government, the CBI, trade associations and the NEDC through all its sector working parties should encourage the use and publicise the benefits of quality management systems**

based on BS 5750; and that purchasers both public and private should make use of independent schemes for assessing the quality procedures of their suppliers in preference to carrying out their own assessments. ***We also recommend*** **that other product sectors follow the example of the fasteners sector and set up similar schemes.**

We would expect that, given the necessary encouragement, nearly all companies currently assessed by public and private purchasers would have been assessed to BS 5750 within 3–5 years.

Product certification and approval

7.9 Like company capability assessments, product assessment is an important route to better design and quality. 'Made in Britain' is no longer a sufficient assurance of product quality in the eyes of many overseas buyers. They frequently require independent approval of the product, or its certification to a widely recognised national or international standard, a requirement which overseas manufacturers are more used to meeting than are British firms. The advantages of effective product certification and approvals schemes are many: they can provide a strong marketing aid; their existence is an essential prerequisite for negotiating mutual recognition with overseas schemes; and substantial improvements in product design can result, with a consequently greater market appeal. Further, approval and certification should not be based on one-off evaluation of sample products, but should require that the manufacturer can produce consistently to the appropriate product standards; in other words, that there is a quality management system in place as described above. The establishment of certification and approval schemes is a task for manufacturing industry itself. Some already exist: in the electrical sector, for example, they are well-established and accepted. In the long term, it is important that the Government help create a demand for schemes by recognising them in its own procurement and that of public purchasers generally, and by recognising them as meeting safety and other regulatory requirements where these exist. In the short term however, pump-priming funds will be needed to establish such schemes.

A principal recommendation **is that individual firms and trade associations take steps to establish many more product certification and approvals schemes, perhaps on a sectoral basis, particularly for internationally tradeable products where quality is important.** ***We also recommend*** **the Government make pump-priming funds available for the establishment of such schemes.**

We would expect the number of schemes to increase from the present few dozen to several hundred covering most manufactured products within 3–5 years.

Accreditation of product certification and approvals schemes

7.10 The status of UK certification and approval schemes in the eyes of overseas customers is also important. If they can be recognised by the UK Government as being based on sound professional practice and independent of manufacturers' interests then this would confer respectability abroad. It would also provide a starting point from which inter-governmental negotiations could take place with the aim on our part of having UK certification and approval schemes recognised in other countries as meeting the legitimate technical and other requirements of those countries. The Government has taken the first step in this direction by circulating for comment proposed guidelines for Government recognition of individual certification bodies. We welcome this. But at the moment there is no overall mechanism for assessing and accrediting the professional competence and independence of certification and approval bodies in a way that carries Government backing. We are attracted by the example of NATLAS, the National Testing Laboratory Accreditation Scheme. The scheme is operated by the National Physical Laboratory, who use assessors from other organisations to inspect testing laboratories and audit their procedures to a defined set of requirements. If satisfactory, they are granted accreditation under NATLAS. We should like to see a similar national accreditation scheme established for certification and approvals bodies, but we recognise that such a task would require different and more comprehensive skills compared with those needed for NATLAS.

7.11 There is a similarity between the mechanics of the accreditation of product certification and approvals schemes and of the assessment of quality management systems in BS 5750. Both are concerned with better quality and both rely on independent audit of procedures documented and maintained by the organisation being assessed. Accreditation complements product certification and approval schemes and capability assessment schemes. The BSI already provides in many cases the latter two of these three elements and the addition of accreditation would complete the picture although other bodies would need to be involved. To make accreditation effective, the Government would have to recognise accreditation as carrying its backing for regulatory purposes and public procurement. The Government would also have to press for overseas governments to recognise the official body for accreditation in the UK. A national accreditation scheme would rapidly acquire significance at home and abroad if a national emblem or mark, augmenting existing marks, were to be associated with it, and widely promoted. It would, we believe, be a considerable aid to those who compete abroad.

> ***A principal recommendation*** **is that the Government establish a national accreditation scheme for certification and approval bodies along the lines set out above; and that, because this work is urgent, pump-priming funds be made available for the early years of operation, to ensure that the necessary skilled manpower be made available and the scheme becomes established quickly.** ***We also recommend*** **that the Government should own, and retain control over the use of, a national mark standing for Quality.**

7.12 The more widespread use of product certification and approval will stimulate the development of a broad range of test methods and procedures, and the formation of close links between manufacturers and test laboratories, as has happened with BASEEFA. There is evidence from the electrical and construction fields that product development costs are reduced and new design possibilities systematically revealed if the test procedures to which the end product will be subjected are devised and used early in the product development process. This interplay should be encouraged. To some extent, the DOI funds the development of new test methods as part of its research support for standards and metrology.

> **We recommend** that the DOI Research Requirements Boards increase their funding of research into new test methods across all the industrial sectors they support.

7.13 In the product sector incorporating trade weighing or measuring equipment, most of the elements just described already exist. Because of fair trading considerations, the Government has powers to require the approval of the patterns (ie designs) of equipment in the use for trade. This and the technical work supporting it, is undertaken by DOT's National Weights and Measures Laboratory. The Government also has powers to oblige users to have such equipment verified (ie tested and stamped with a distinguishing mark – a crown for our national mark) by local authorities to ensure conformity with the approved pattern and the relevant Regulations. Furthermore the authorities have the power to inspect periodically the equipment to ensure its continuing conformity. The product design, the approval process and the verification procedure all rest on the science of metrology. Fundamental research in metrology is Government-financed at the NPL which also operates the British Calibration Service ensuring the traceability of measurement standards for industry. Measuring equipment is an industrial sector where British goods are already well-regarded abroad, and, we think, could do even better if greater publicity were given to the Government involvement in technical work supporting the regulatory framework and the way it underpins the design and quality of the goods produced whether for trade purposes or general industrial use. At present metrology research and traceability of measurement standards for industry rest with the DOI, whereas the responsibility for technical work supporting design approval of trade measuring equipment lies with DOT. We think the sector would be better placed to compete internationally if responsibilities for the science of metrology and technical work supporting legal metrology were combined in a single Government department.

> **We therefore recommend** that responsibility for metrology and the technical support of legal metrology be brought together.

Regulations and their making

7.14 The Government should aim for a more consistent approach to regulation. There are no published guidelines setting out the Government's philosophy and approach to regulation, the procedures by which regulations are made, the mechanisms for linking them with standards and voluntary codes of practice, and the ways in which they can be enforced. A consistent approach to regulation by all regulatory bodies is unlikely in the absence of such guidelines.

> **We recommend** that the Government prepare and publish guidelines setting out the Government's philosophy and approach to regulation, the procedures by which regulations are made, the mechanisms for linking them with standards and voluntary codes of practice, and the ways in which they can be enforced.

7.15 The approach taken to regulation can have significant implications for the cost of enforcement. At present, the UK approach aims to identify products which turn out to be unsafe and then remove them from the point of sale or the workplace where they are used. The enforcement process is thus diffused among local authority trading standards officers and HSE inspectors. The West German approach aims to prevent products deemed unsafe from ever being put on the market, whether manufactured domestically or imported. The enforcement process operates on the manufacturer or importer, and relies heavily on certification and approvals schemes.

We therefore recommend that the Government adopt a preventative approach to the enforcement of safety requirements in the UK, making use of independent certification and approvals schemes wherever possible.

7.16 In making regulations, UK agencies should take full account of the requirements of European directives and regulations and to international practice. We would cite particularly the UK's Electrical Equipment (Safety) Regulations, mentioned in the study of the electrical and electronic components sector, which is at variance with the European Low Voltage Directive in that it obstructs rather than assists industry in meeting safety objectives through compliance with recognised standards. There are few examples of harmonisation between regulations in various countries. This shortcoming is a serious inhibition to the further development of EC and international markets, and the burden of meeting the different requirements of various national markets is a significant cost to those companies with international horizons.

We recommend that regulatory departments, notably the Departments of Trade and Environment and the Health and Safety Executive, review the consistency of their regulations with those of the European Community and other countries and make changes accordingly.

7.17 Valuable technical resources are devoted to the consensus standards-making process to which the Government also makes an input. In many cases the making of regulations involves duplicating this effort. Furthermore, although the Government has every opportunity to specify its requirements (regulatory and otherwise) during standards-making, it does not at present consider itself under an obligation to use in any way the standards which result. This must be remedied and the greatest possible interdependence established between British Standards and regulations.

We recommend that the regulatory departments of Government should nominate representatives on standards-making committees who can state what is needed of a standard if it is to be used in regulation and have the authority to commit their departments to using it unless, in exceptional cases, they have indicated to the committee at an early stage in the standard's development why it is likely to be unsuitable.

Public sector purchasing

7.18 Public purchasers have an essential part to play in encouraging the use of British Standards and in establishing the acceptability of independent certification and approval schemes – by using them in their own purchasing in the UK. As we said in our earlier report 'R & D for Public Purchasing' (paragraph 7.18): 'we think that public sector organisations should seek to meet their requirements with equipment that can be sold in international markets, even if this means some compromise over specifications'. We heard widespread criticism that public purchasers use their own parochial standards and assessments procedures and that this adds both to the burdens on suppliers and to the costs of purchasers.

7.19 The purchasing under the direct control of central Government can be more readily influenced by Government purchasing policies than that of the local authorities, nationalised industries and public corporations. We welcome the move of the DOE Property Services Agency (PSA) to specify products having the BSI Kitemark (or other acceptable third party certification, including Agrement) where they exist and the PSA's dialogue with BSI to develop more Kitemarking schemes to cover products required by the PSA. We also welcome the decision of the Ministry of Defence to accept compliance with BS 5750 as proof of the capability of their sub-contractors to produce to the required quality level. These examples should be followed by other public purchasing bodies.

7.20 Public sector purchasers, including central Government, local authorities, nationalised industries and other public bodies, should seek to have their requirements embodied in independent, nationally-recognised standards and schemes. Where appropriate, these could take the form of graded British Standards containing different sets of requirements for different uses from which all purchasers could choose. We understand that top management in nationalised industries and public corporations agree broadly with the enlightened use of purchasing power but this view is not fully reflected in actual purchasing practice. The Government has a number of mechanisms (mainly financial) for ensuring that public sector institutions act in accordance with its wishes, for example the Department of the Environment's grant to local authorities for the purchase of only that street furniture in the Design Council catalogue.

> ***A principal recommendation* is that the Department of Industry – as co-ordinating department for the Government's public purchasing initiative – require Government Departments, and urge other public bodies (by whatever necessary means), to make use of British Standards, independent product certification and approval schemes and independent schemes**

for capability assessment of their suppliers, encourage the development of independent standards and schemes which meet their requirements, and embody these initiatives in revised guidelines for public procurement.

7.21 A strong and well-constructed system of British Standards and schemes for demonstrating compliance with them would be in the interests of purchasers in the private as well as the public sectors. They can encourage the establishment and use of such a system through their own purchasing.

A principal recommendation **is that the Confederation of British Industry and the National Economic Development Council through its sector working parties encourage the support of British Standards and product certification and approvals schemes for private sector purchasing.**

British Standards and standards-making

7.22 Standards can and should underpin certification, approval, technical regulation and procurement. Industrial and governmental commitment to the making of British Standards is patchy and there has been an apparent indifference to the benefits to be gained from the use of standards. The Government has not sought to make maximum use of standards in achieving regulatory goals. Government representatives on technical standards-making committees are in practice frequently there primarily as technical experts, and do not articulate well-defined Government policy.

7.23 A strong body of safety standards will be valuable so that compliance with Standards is a prima facie defence in court, and a mitigating factor in setting insurance premiums. Not all British Standards dealing with safety are, at the moment, suitable in content or drafting to be the authoritative guidance as to what is considered safe. Neither are some standards which cover other matters as well as safety. This needs to be remedied. Certification and approvals bodies can provide useful feedback to help ensure that standards intended for certification schemes can be so used and contain all the requirements. Such standards will provide manufacturer (and purchaser) with guidance as to an acceptable degree of safety in a product and prepare the ground for product liability legislation. Although this does not yet apply in the UK, it is likely to be introduced as a European Community (EC) measure which the UK will have to take account of. When the time comes, manufacturers, purchasers and insurers will need at least the same assurances about the safety of products that are available in other countries, including particularly Government-backed recognition that standards, certification and approvals offer some defence in law.

> ***A principal recommendation*** **is that the Government consider changes to the Consumer Safety Act and the Health and Safety at Work Act to give more general recognition for British Standards as meeting legal requirements.**

7.24 Increased use of British Standards, and certification and approvals schemes based on them, in regulation and procurement will demand responsiveness from the BSI. Standards of the appropriate technical content and high quality will be needed in good time particularly in innovative and competitive industrial sectors. In recent years, BSI has done much to improve its procedures, notably through publication of a revised standard for standards (BS 0, described in Annex B).

> ***A principal recommendation*** **is that BSI continue to streamline its operations, and industry and Government provide sufficient support (financial and otherwise), for the preparation and maintenance of a strong body of British Standards.**

7.25 International harmonization of standards may well benefit all manufacturers in the long term. We understand, however that other individual European countries have more ISO and IEC secretariats than we do, and that they frequently have draft standards ready well in advance for international adoption (and the technical back-up to press their case). Such drafts may well reflect their current manufacturing practice, and their adoption internationally is likely to give overseas manufacturers a competitive edge. To counterbalance this, the UK should take more of the initiative in international standards organisations.

> **We therefore recommend** that industry, through Trade Associations and the BSI, organise greater industrial strength, initiative and anticipation of opportunities in international standards-making.

7.26 The British Overseas Trade Board provides support (about £400,000 pa) for the travel costs of UK delegation leaders attending meetings of international standards bodies. The Department of Trade has indicated that this support may be discontinued. We have stressed in the preceding paragraph the implications which initiative in international standards discussions can have for trading advantage.

> **We therefore recommend** that Government support for UK delegations attending international standards forums be maintained and, if need be, increased to cover a greater proportion of all delegate costs.

7.27 In some countries such as West Germany, standards are originated largely as codes of design and practice drawn up and disseminated by professional institutions. In the UK, such institutions already play a role in providing focal points for the various professions which they represent and various of them are also active in standards and design through, for example, the production of design guides and operation of schemes such as the Pressure Vessels Quality Assurance Board. But they could contribute much more extensively and effectively, for example, in providing representatives on BSI committees; encouraging their membership to adhere to the relevant British and international standards and regulations; identifying areas where new or revised standards are required; identifying shortcomings in existing standards by contact with members; making representation to BSI committees where standards are exerting undue constraints on product manufacture or competitiveness; producing up-to-date codes of design practice which could be widely adopted in industry and by purchasers and which could form the input to British Standards-making.

> **We recommend** that the engineering profession through the membership of the professional institutions undertake the tasks listed in this paragraph, and be funded under contract or by other appropriate means.

7.28 There is also a need for more comprehensive research and technical work to support specification standards. This includes the research, design, development and construction of new test equipment or evaluation of new test methods, and the provision of specialist technical information and reviews of changes in technology. While DOI Requirements Boards have a remit to provide this kind of support, the volume of work undertaken is insufficient properly to support the standards-making effort. Similar technical support is also needed for the Agrement Board. The relationship between research and the Agrement Board's work has been and needs to be very close.

> **We therefore recommend** that the volume of research and technical work for specification standards supported through DOI Requirements Boards be increased appropriately, and that the Agrement Board be assured adequate technical support through appropriate channels.

A corollary for the BSI is that it should be prepared to provide advice on the technical work required and itself to make more extensive use of outside organisations in the preparation of draft standards.

Government responsibilities related to standards

7.29 We have pointed out the strong influence which design has on product competitiveness, and the way in which standards underpin regulation, procurement, certification and approvals – which are themselves major factors influencing design. It therefore seems sensible to draw together responsibilities within Government for design and standards in an industrial context. The Design Council is sponsored by the Department of Industry and the BSI by the Department of Trade.

> ***A principal recommendation* is that a single department be made responsible for design, standards policy, and sponsorship of BSI and the Design Council.**

7.30 Great dissatisfaction has been expressed over the policing of claims of compliance with standards and regulation, notably those involved in the Trade Descriptions Act. Prosecutions are protracted and penalties are negligible. For this reason, people are unwilling to start litigation even though they have a right to do so whether or not they are the aggrieved party, and local trading standards officers, who police the Act, work under several other pressures. Further, the sale of counterfeit goods (such as those with false certification or standards markings, as well as those infringing copyright, registered designs or patents) has a high cost in terms of lost UK trade. Counterfeiting is difficult to quantify but in the fasteners area is said to be considerable.

> ***A principal recommendation* is that the Department of Trade organise more aggresive pursuance of false claims of compliance with British Standards under present legislation; and consider legislative changes to make prevention of false claims more effective and to counteract counterfeiting.**

7.31 We have cited the savings to be made by engineering companies who can operate a single standardised measurement system instead of both imperial and metric. Abandoning the metrication programme and abolishing the Metrication Board was a retrograde step, creating impediments (such as the prohibition of dual pricing) to metrication in the engineering industries. The potential savings for manufacturing industry deriving from complete metrication far outweigh any disadvantages occasioned by restricting firms' freedom of choice whether to adopt the imperial or metric systems.

> **We recommend** that the Department of Trade now urgently pursues a renewed metrication programme.

Education and training

7.32 Because of the influence of standards and procurement on design and competitiveness, it is vital that engineers, designers and other specifiers fully appreciate the requirements placed upon them. A detailed acquaintance with standards, regulations and other requirements, is best learned on-the-job in the particular environment of each firm, its products and markets. But awareness that such requirements exist, and their use and benefits, should be part of a designer or engineer's professional equipment which he or she acquires during education and training. Firms themselves should do much more to acquaint engineers with the role and importance of standards, certification and approvals, during their final year of professional training and this is a matter for the early attention of the Engineering Council. Tertiary education in technical subjects should include such awareness. Equally, the professional institutions and the Design Council can help for example by preparing and making available handbooks and data sheets outlining the place of standards, and product and capability assessment in design, marketing and manufacture. In schools awareness of these subjects should form part of a 'liberal' technological education, including relevant science and engineering subjects and mathematics, available at least for those who will go forward to higher and further education in science and technology. After some years at work, there is a clear need for mid-career engineers and designers, as well as educators and instructors whether academic or from industry, to undergo regular short (a month or less) refresher courses and to update their skills and awareness both of design techniques and technology and of the standards and regulatory environments of which they or their students have to take account.

> **We therefore recommend** that firms, education and training establishments, the professional institutions and the Engineering Council individually and jointly ensure that personnel who are responsible for the design and specification of products are fully acquainted with the role and importance of standards and product and capability assessment, and their implications for national competitiveness.

Institutions could well include a requirement for competence in these subjects in their membership rules.

7.33 In firms, there should be a flow of people through production, design and quality assurance departments. We are glad to hear that in some firms quality managers have several years experience of development, marketing or production. We consider this important in ensuring that technical and commercial considerations are married together, to the benefit of both.

> **We recommend** that the CBI, the trade associations, the Engineering Council, the professional institutions, and firms themselves promote the interchange of personnel between design, development, marketing and production functions.

Co-ordination

7.34 In many overseas countries, the institutions involved with standards and regulations are closely integrated. By contrast, institutional arrangements in the UK are fragmented and, as a result, effort can easily be wasted through duplication, conflicts or lack of contact. Many different institutions are active in standards and regulation in the UK. Among these: the BSI is the national body responsible for specification and systems standards; the NPL and NEL for measurement standards and test-house accreditation; NEDC Sector Working Parties for sectoral quality schemes; Trade Associations for work connected with standards and quality schemes; DOI Requirements Boards for funding some research to provide the base for standards; professional institutions (patchily) for codes of practice such as the Institution of Electrical Engineers' Wiring Regulations and schemes like the Mechanical Engineers' Pressure Vessels Quality Assurance Board, as well as training and professional guidance; the Design Council for promotion of design and its own approval scheme. Responsibility for national regulation is split among many Government departments including those of Trade, Industry, Employment, Environment, Transport, Health and Social Security, the Ministry of Agriculture, Fisheries and Food, and the Home Office. In addition, various departments sponsor, or are themselves, major public purchasers whose influence on national purchasing practices and requirements is very great. These elements between them perform most of the needed tasks, but their policies and practices should be much more closely integrated and greatly improved in their effectiveness.

> ***A principal recommendation*** **is that the Government set up a strong inter-departmental committee to act as a central focus for policies towards regulation, standards, certification and approvals.**

This would bring together within Government the activities outlined above.

7.35 There are however many tasks which fall outside Government but which need to be carried through, as well as linkages to be established between non-Governmental bodies and the inter-departmental committee. It will also be crucial for the effort within Government to be properly attuned to the industrial and commercial needs of the UK.

> ***A principal recommendation*** **is that a strong advisory group be set up to provide an interface between Government and non-Governmental bodies in the field of regulation, standards, certification and approvals, and to ensure that effort within Government is properly attuned to the industrial and commercial needs of the UK.**

7.36 The Group should advise Government and non-Governmental bodies from the centre, and should be free to recommend legislation as well as other measures. It should be independent of the sectoral interests of supplier and purchaser, and of individual Government departments. Its membership should be on a personal rather than representational basis but the emphasis should probably be on major industrial companies with international horizons. The chairman could be either a Minister or a respected industrialist. The Group would need a small and expert secretariat. It should also have such modest funds at its disposal as it needs to commission studies and to gather information for its own use. The Group should be subject to review after 5 years. Its terms of reference should be to advise on –

- Measures to ensure the implementation of the recommendations of this report, should they be endorsed.
- The industrial and trading implications of the Government's approach to the making and enforcement of regulations.
- Measures to strengthen the support given by our system of regulations, standards, certification and approval to the design, quality and competitiveness of British manufactured products.

Annex A

The terminology of standards and regulations

1. *Standards* pervade all manufacturing and service industry activities. They are intended to form a rigorous technical basis for the assessment of quality, performance and other physical attributes of products – including ancillary factors such as packaging, labelling and procedures for testing. Standards are of several kinds.

2. *Measurement standards* define or reproduce by means of equipment or apparatus the unit of measurement of a quantity (such as mass or length), which can then be transmitted to other measuring equipment. Measurement standards are authoritative only insofar as they are traceable back to definitions of quantities made in an absolute rather than comparative way. The science of measurement, *metrology*, is pursued in all industrialised countries to ensure, for example, that the dimensions of components made in one country match those made to the same specification in another. *Legal metrology* is concerned with measurements that are made in connection with buying and selling goods; for example weighing scales and petrol pumps are required by law to be 'fit for the purpose of trade'. In practice, this means that they must be accurate and consistent within set limits. Such instruments and equipment must be officially examined and approved, frequently at the design or prototype stage (*type approval*), and periodically checked and recalibrated during their working life.

3. *Product specification standards* are documents which prescribe in detail requirements with which a product has to comply. A specification standard may include definitions of terminology, dimensions and tolerances, preferred sizes and types, methods of test and specifications of quality, safety and performance. Such specifications must be generally recognised and authoritative if they are to be useful. Recently, in the UK *systems standards* have been developed embracing processes and quality management. For example, process standards are codes of practice describing how to install, maintain and use particular equipment. *Quality management standards* such as British Standard 5750 lay down procedures to help ensure that goods can be con-

sistently produced to a defined level of quality. Quality management standards involve assessing the capability of a company and its procedures, as distinct from assessing its products. Product specification and systems standards reach their final form by consensus among the interested parties.

4. *Quality* may be thought of as those features and characteristics of a product or service that bear upon its fitness for purpose. In assessing fitness, compliance with specification will be involved, but so will time-dependent factors such as maintainability, reliability and other characteristics. *Quality assurance* is concerned with all the activities and functions which are connected with the attainment of quality. Standards for quality management are generally centred around the contract between the supplier and the purchaser, in which the purchaser specifies his requirements. The supplier will be expected to establish, document and maintain a system to ensure and demonstrate that the products or services conform to the purchaser's requirements or, if he has not prescribed any, to the supplier's own requirements. As distinct from quality, *grade* is the degree of refinement of a product. For example, a disposable plastic cup is a low grade beverage container which may none the less be of high quality if it is fit for its (limited) purpose; whereas a supposedly high grade bone china cup may be of low quality if its glaze cracks after a month's use.

5. *Regulations* are documents generally having legal force which impose controls or restrictions, frequently by defining the limits of the acceptable. They gain their status from primary enabling legislation. They may refer to national standards which then may either have the force of law, or indicate a way of achieving full or partial compliance with the law. Regulations are administered by Government departments or regulatory agencies which determine their final form.

6. *Compliance* is a judgement that a product meets the requirements of a relevant specification or regulation. Demonstrable compliance with specific standards can be formalised by *certification* through the use of a document or mark. Products may be certified by the manufacturer, by an independent test house or by a regulatory body. By contrast, if a product fulfils a published set of criteria which includes more subjective judgements on aesthetics, ease-of-use and similar aspects of design, as well as (probably) compliance with specific standards and safety regulations, a body vested with the necessary authority may give its *approval* that the published criteria have been fulfilled. For example, the approvals requirements for a foam-filled chair might include not only safety from toxic hazards in the event of fire but also comfort and durability.

Annex B

Standards for standards and quality management systems

BS O: A standard for standards

1. BS O 'A standard for standards', published in revised edition at the end of 1981, is essentially a text book on the preparation of British Standards. Its three parts provided guidance to BSI committee members and others on the general principles of standardization (part 1), BSI and its committee procedures (part 2) and the drafting and presentation of British Standards (part 3). The more detailed guidance now provided in part 3 in particular is intended to ensure that British Standards are suitable for the defined purpose for which they are required.

Standards for quality management systems: BS 5750 and Ministry of Defence 05–20 series standards

2. Over the years, there has been increasing interest in the development and implementation of quality management systems to improve the quality of products and supplier ability to produce consistently to a defined quality level. Such procedures were first developed for the aerospace and defence industries and in the UK were codified in the Ministry of Defence 05–20 Series of Defence Standards. These were introduced in their present form by the Ministry of Defence Procurement Executive over a decade ago and aimed at establishing purchasing disciplines which would benefit not only the Ministry of Defence itself as the customer, but also the supplier, if possible making him more able to compete for overseas contracts. The 05–20 series drew on American-orientated NATO standards but places greater emphasis on design and requires inspection of every contractor's organization for registration before contracts are awarded.

3. BSI issued its first basic reference standard on quality assurance in 1971, with the first edition of BS 4778: 1971 'Glossary of terms used in quality assurance'. Subsequently BSI have published a number of national standards relating to quality assurance, including BS 5750 'Quality Systems'. In

addition, many major purchasers, such as nationalised industries and motor vehicle manufacturers, operate their own quality assurance schemes with appropriate domestic standards. Both BS 5750 and Ministry of Defence 05–20 series standards provide standards for quality management systems against which suppliers may be assessed – a procedure often known as 'capability assessment'.

BS 5750 'Quality Systems'

4. BS 5750 was published (November 1979) in three parts –

Part 1: 'Specification for design, manufacture and installation' dealing with the quality system to be applied when the technical requirements are specified principally by performance or where the design has not been established.

Part 2: 'Specification for manufacture and installation' concerning the system to be applied when requirements are specified in terms of established design and manufacturing practice, but where conformity can be ensured only by inspection and test during manufacture and installation.

Part 3: 'Specification for final inspection and test' specifying the quality system to be applied when conformity with requirements can be adequately established by inspection and tests on finished products or services.

Last year (1981) Parts 4–6 followed providing corresponding guides to the use of Parts 1–3. BS 5750 is based on the experience in use of BS 5179 'Guide to the operation and evaluation of quality assurance systems' published in the early 1970s, which in turn was based on the comprehensive quality control requirements of the 05–20 series of Defence Standards.

5. In three succinct, easily assimilable documents BS 5750 specifies requirements for three basic levels of systems for the assurance of quality of products or services, or both. It covers the organization, review and planning of the quality system; the necessary control of various functions and products; the records and documentation required to demonstrate that controls are effective; and the training that may be needed to operate the system effectively. The standard can be used in a number of ways. It may form the basis for evaluating the supplier's quality management system or

be involved in a contract to specify appropriate quality assurance requirements.

6. The quality assurance requirements of BS 5750 are both flexible and comprehensive, permitting a choice of quality requirements to suit individual circumstances. They are flexible because they can be applied to major projects involving design, development, manufacture and installation or to small purchases of simple items. They are comprehensive because they ensure that all those features of a contractor's organization that bear on quality in fact do so. They make no reference to specific products, thus ensuring their widespread applicability. They concern themselves solely with specifying the management system that the contractor must have and the activities he must engage in if the customer is to be assured that he will receive products of the requested quality.

Annex C

Product sector study reports

1. Four sector studies were undertaken to assess the ways in which companies identify and comply with differing technical requirements – whether British, overseas or international – which affect the design of their products. Evidence and opinion were also sought of other ways in which standards and regulations affect companies in meeting market requirements. The four product sectors were:

electrical and electronic components
videotex systems
industrial fasteners
metal and plastic-framed windows

The criteria for selecting sectors were: widespread use of the end product; high added value; international tradability, and design and quality being important to their international competitiveness.

ELECTRICAL AND ELECTRONIC COMPONENTS

2. The scope of this study includes electronic components – semiconductors and passive components such as resistors and capacitors – and electrical components such as switches, fuses, timers and cathode ray tubes. The turnover of this sector was about £1,200M in 1979 of which about 50 per cent was exported.

3. The study was conducted by means of correspondence and structured interviews with 7 firms, supported by submissions from the British Electrical and Allied Manufacturers' Association (BEAMA) and consultations with BEAMA's officers and officials.

4. Firms in the sector are closely involved in the formulation of standards and regulations, mainly through BEAMA. The standards and regulations affecting products cover principally *electrical safety*, the *performance* of

components and their *quality*. These three areas are dealt with individually, as well as other matters.

Electrical safety

5. In the UK, electrical safety is the subject of two principal pieces of legislation: the Health and Safety at Work etc Act 1974 for industrial uses of components and the Electrical Equipment (Safety) Regulations 1975 made under the Consumer Protection Act 1961 for consumer applications. Any new regulations would be made under the Consumer Safety Act 1978.

6. The Health and Safety at Work etc Act (HSWA) provides for a requirement that certain products comply with the relevant British Standard and the Health and Safety Executive (HSE) is moving – rather steadily – in the direction of recognising certain product standards for regulatory purposes. Standards are also used in the HSE's informal and administrative guidance. Respondents had little to say about the effect of the HSWA on their business.

7. Great dissatisfaction was however expressed about safety regulation in the area of consumer applications. The Electrical Equipment (Safety) Regulations 1975 were made under the Consumer Protection Act 1961, which does not enable direct reference to standards. The Government connects these Regulations to Standards by the issue of administrative guidance which states that it can reasonably be assumed that compliance with certain standards can be regarded as compliance with the Regulations. This guidance does not form part of the Regulations and is thus not an instruction from Parliament to the courts. It is addressed to enforcement officers, as well as manufacturers, and the former will be unlikely to initiate action against goods complying with standards so mentioned. There is however no assurance to a manufacturer that if he ensures that the goods he produces comply strictly with a standard listed in the guidance, he is free from all risk of prosecution for failing to comply with the Regulations.

8. The Consumer Safety Act 1978 permits direct reference to British Standards in regulations and the Electrical Equipment (Safety) Regulations are being revised to take advantage of this facility. But any reference to a Standard in regulations must be to a specific issue of that standard and each amendment to a standard once cited must be approved by Parliament. The technical content of an agreed Standard may thus be altered by 'translation' into legal language, and such translation greatly reduces the usefulness of the standard

as a technical reference document. However, it is not necessary to cite standards under the 1978 Act. Instead, safety regulations can empower the Secretary of State for Trade to approve standards without recourse to Parliamentary approval for specific standards and it is proposed to adopt this course in new regulations. Because this course would not permit divergence from the letter of the standards to allow for innovation or even for discrepancies that did not prejudice safety, it is proposed to provide also for a prior approval system as an alternative route to compliance with the regulations. But this option would tend to undermine the position of British Standards.

9. There are over 60 draft European Directives in the electrotechnical area (though not solely concerned with safety) issued under Article 100 of the Treaty of Rome. Many directives call for the drafting of international technical standards. In the electrotechnical area these are made by the European Committee for Electrotechnical Standardisation (CENELEC). Much of the electrotechnical work of the British Standards Institution (BSI) is concerned with CENELEC discussions, and with implementing the resulting standards nationally. In particular, the Low Voltage Directive affects this voluntary standards-making activity as does the UK's own safety legislation.

10. The primary requirement of the Low Voltage Directive is that electrical products must be allowed onto the market only if, having been constructed in accordance with good engineering practice in the EC, they are safe when properly installed, maintained, and used for their proper purpose. Products are deemed safe if they comply with harmonised EC or international standards, or the national standards of the EC country of manufacture. Compliance is presumed if products have received certification or approval to that effect by certain authorised bodies, or if the manufacturer declares that his product complies. But the instrument through which the UK has chosen to implement the Low Voltage Directive is the Electrical Equipment (Safety) Regulations and, as explained above, these do not recognise demonstrated compliance with standards as a presumption of safety.

11. The effect of this is to inject uncertainty into design, marketing and manufacturing activities in this sector and to inhibit the emergence of the high volume market for standard products on which this sector depends.

Certification and approval

12. Certification and approval by third parties is not at present mandatory in the UK (except for equipment used in mines), although it is in some other

countries. It is however a common customer requirement that electrical goods receive type approval by the British Electrotechnical Approvals Board (BEAB) or other bodies, and this requirement devolves onto the component supplier as well. Approval in the UK involves testing to ensure that the product complies with the relevant British Standard together with other tests which, in the judgment of the tester, are required to ensure the safety of products. Approvals bodies sometimes feel it necessary to use tests which may be more stringent than British Standards to defend themselves against the possibility of legal action if an approved product fails. Furthermore, the extra tests are not always formally documented or incorporated subsequently into the British Standards and, although they become known to the manufacturer, they are not subject (at their inception) to the consensus standards-making process.

13. Component suppliers have to meet the standards and regulations of overseas purchasers not only of components, but of assembled products as well. While identifying the requirements is not generally a problem – except where documents are only available in the original language – export of assembled goods to an unexpected destination can involve component suppliers in meeting a new set of requirements at short notice. This can cause markedly increased costs and other difficulties, especially when certification or approval of components is required by overseas purchasers. International harmonisation of standards and regulations – eg under the auspices of the Low Voltage Directive – and reciprocal recognition of test-houses for certification and approvals would be of great help.

14. Periodic audit tests to ensure that production items comply with requirements, and factory surveillance on behalf of the approvals body to check on international quality control procedures, mean extra costs incurred by the firm – up to 4 per cent on the product cost in some cases. Such costs might render low volume products uneconomic.

Performance and quality

15. A special case of standardisation in the electronic components field is the British Standard series BS 9000 and its European analogues. Like the BSI's Kitemark certification schemes, conformity of production testing and factory surveillance visits are involved. Standards which specify the tests to be carried out can be an unsatisfactory compromise. As a result, there may be some tests which customers want but suppliers consider unnecessary, whilst other tests are omitted which suppliers carry out anyway for commercial rea-

sons. Some purchasers prefer to buy components straight off the production line without paying the premium which demonstrated compliance with standards involves. This preference does not necessarily reflect a demand for components of low performance or quality – indeed, the reverse is the case with components for the television industry.

16. Partly because of the very high quality and reliability claimed (and achieved) by Japanese TV manufacturers, UK component suppliers and TV manufacturers started collaborating to reduce the reject rate of components from UK suppliers. The firms jointly identified defects in component manufacturing processes; mismatches between component specifications and actual requirements; and television assembly and testing procedures which damaged components. This close co-operation resulted in a marked improvement in component quality – now measuring failures in parts per million (ppm) – and in final product quality which is now on a par with TV sets of Japanese origin. It was especially suitable for the TV business where high volume and long production runs gave time for quality information to be fed back and acted upon. Such an open relationship between supplier and purchaser is however at odds with the traditional relationship between salesman and buyer, and the necessary re-education process is not always straightforward.

17. One rather perverse consequence of this drive to higher quality has been a comparative neglect of British Standards. TV manufacturers see no point in paying the premium involved in demonstrating compliance with BS 9000 – although the standards do provide a discipline on which the parts-per-million approach can be built. One firm estimated that 10 per cent of its business (mainly for public purchasers) was to BS 9000 or its European analogues, with a further 40 per cent for TV manufacturers. The remaining half of the firm's production however was not specified by customers against any independent standard at all. This was not thought to be untypical. Part of the explanation may be that standards cannot keep pace with integrated circuit development – where customers tend to want the latest available component whether to British Standard or not. On the other hand, standards for established passive components tend to reflect real commercial needs and current technology to a degree where production lines can be BS-only and the products do not command a premium. An additional factor in component performance and quality is the part played by formal third party quality management systems.

Quality management

18. Several of the firms contacted were assessed for compliance with Defence Standards such as 05–21, 05–24 or BS 5750 which specify objectives and procedures for quality management. This was felt to be a commercial advantage since purchasers are tending to show interest that their suppliers operate recognised quality management systems, and multiple inspection visits can often be avoided. However, the assessments are done for a specific customer – whether MOD or other – and subsequent customers may not be entirely satisfied that their own specific needs are safeguarded. An authoritative single recognition of these various assessments is desirable. The view was also expressed that the periodic third party audits made under quality management systems tend to be pedantic on procedural matters, whereas a more pragmatic approach might be possible without losing sight of the ultimate objective of consistent product quality.

Other issues

19. *Standards-making* in the UK is generally felt to be adequate, if rather slow. Standards are generally well-established, tending to be inert rather than responsive, but would need up-dating and refinement to provide even a baseline of acceptability on safety matters. This would be a necessary pre-requisite to their reference in regulations. *Information* about UK and overseas standards and requirements is readily available through BSI and its Technical Help to Exporters service, although more help with the translation and interpretation of overseas requirements would be useful.

20. With the prospect of *product liability legislation* at some time in the future, attention needs to be paid to the role of standards in providing a guide and defence to manufacturers. To be adequate as design guidelines, standards need to reflect the state-of-the-art, without recourse to additional tests and requirements which have historically not been well documented or disseminated. In the area of electrical safety, some quasi-legal status for standards would help provide a prima facie defence in the event of accident for manufacturers who complied with them, and also have some mitigating effect on the insurance premiums.

21. *Training* in quality management and awareness of standards and regulations is mainly conducted on-the-job. Induction and management courses frequently contain an element of standards training and, in the larger companies, quality managers receive periodic specialist training as well. In one

firm, the majority of quality managers had previously spent a significant amount of time in production, marketing and other business areas.

Conclusion

22. In the study of this sector, the two pervading themes are electrical safety and quality management. Customer-led requirements for product certification can help to maintain commitment to standards, provided they are not undermined by additional unilateral and arbitrary (if justified) requirements. In the field of quality, experience has shown that much can be achieved by close collaboration between supplier and purchaser.

VIDEOTEX SYSTEMS

23. Videotex is an Information Technology development involving data processing, telecommunications, information provision and the supply of hardware such as computers and video terminal equipment. This sector study was thus mainly undertaken through interviews with five representative suppliers and the relevant trade body, the British Radio Equipment Manufacturers' Association. Further written input was obtained from others in the field.

24. Videotex is used here as a generic term embracing both *teletext* – the one way continuous transmission of frames of graphics and text 'piggyback fashion' with video signals – and public or private *viewdata* – the two way transmission of similar frames along telephone lines or cables. Outward bound frames are displayed on a video screen. The return signals convey simple transaction decisions back to the information source, held on a computer. Both access 'pages' of data held on computers, updated by 'Information Providers' (IPs) who offer information and services in a form readily accessible to authorised lay people. This fast developing sector has obvious interrelationships with other developments in information handling such as high speed telex (teletex), facsimile (telefax), broadcast software (telesoftware), cable TV and word processing; and with videodisc, satellite transmission and image processing.

25. Videotex is at present a small but significant market. In Europe, between 1982 and 1992, software house revenue could rise from £8M to £60M per annum and the related terminal and computer business is likely to rise from £20M per annum today to £130M pa in 1992. British Telecom (BT) and other

European Posts and Telecommunications Authorities (PTTs) would also benefit from demand for their facilities, and the IP videotex-related gross revenue could rise from £4M pa to £100M pa. While the early UK lead and evident intention to sustain that position should bring a healthy balance of trade, an equally important domestic benefit comes from increased economic efficiency resulting from widely available accurate information, and the cost savings arising from reductions in inventories and the quality of information that application of videotex can bring.

26. Viewdata can be exploited as a public service, eg the Prestel service operated by BT (where information is made available by IPs, for a fee); or in the form of private systems used by companies needing their customers or themselves to have up-to-date information, eg by travel agents, mail order businesses, investment analysts, commodity dealers or motor distributors. Such private systems generally consist of a complete package of hardware and software. Access via the public service system and thence through the Packet Switch System (PSS) to any authorised third party computer database is known as *Gateway*.

27. The export opportunities in videotex include: software and systems for all aspects of the transmission and management of data; the computers themselves; and video terminals (or components thereof) on which the user selects and displays data.

28. The videotex industry exemplifies the way that standards evolve. It also demonstrates the electronics industry's reliance on a mass market. Without the scale economies so provided, the business opportunity dies. It is thus in the interests of companies and the nation to allow business forces and advancing technology to influence future standards, which allow manufacturers to capitalize on the R & D investment.

Standards and regulations

29. Standards and regulations affecting videotext products fall into several broad types. First, the hardware involved must comply with *electrical safety regulations*. The standards underlying these are harmonised through Europe under the auspices of the European Committee for Electrotechnical Standardisation (CENELEC) and national regulations which generally involve implementation of the EC Low Voltage Directive. There have however been problems in the UK (see the Electrical and Electronic Components Study). One relevant feature of viewdata is the juxtaposition of the high voltages

present in video displays with the public telephone network, which could easily have meant delays while the implications were thought through. In the UK, there was a self-certification agreement between the (former) Post Office and terminal manufacturers that the Post Office's specification for Prestel terminals would be met. With telecommunications liberalisation, such agreements are no longer appropriate and safety arrangements will have to be brought within the BSI/BEAB electro-technical approval process.

30. Second, the *suppression of electrical interference* is the subject of standards which are in some countries mandatory. As with electrical safety, national interests can influence approval procedures, even though the standards themselves may be harmonised.

31. Third, though in most countries the market is left to decide between alternatives on the basis of product performance, a few have standards regarding *ergonomics and human factors*. The West Germans for example specify the attitude of the keyboard to the table top on which it rests and, for certain office environments, the display character format. BT did useful work on the minimum number of videotex keypad characters but sensibly left layout and colour coding to manufacturers.

32. Fourth, standards and protocols in *telecommunications* strongly influence the exportability of UK videotex products. That the seminal standard in this field is Prestel is a matter for which BT in particular should take credit and from which UK suppliers to the international market should benefit.

33. Fifth, the BT liberal licensing attitude to videotex and prior art claims mean that *patents* are not an issue. In particular the Prestel Terminal Specification is available to anyone wanting to build one. Sixth, the important subject of *data transmission* standards is outside the scope of this discussion. Finally there is a general requirement that the information provided shall be lawful and meet national data protection laws. The International Association of Videotex Information Providers has drawn up a voluntary code of practice on page content and IP activity.

Private and public viewdata systems

34. The UK not only invented videotex but has also generally stayed in the lead during its implementation. Although other countries have conducted extensive trials, the UK was the first to have *public* teletext and viewdata systems, respectively Ceefax (BBC) and Oracle (ITV), and Prestel. Prestel's

initial design and development presumed take-up by a mass consumer market and that the viewdata terminals would mainly be derived from modified domestic colour TV receivers. But the consumer market did not grow as envisaged and the main applications in the near future are likely to be in business, for whom numerous purpose built terminals and software systems have been developed.

35. One design attribute was ease of use, leading to a standard 24 row, 40 character graphic layout and a numeric, rather than alphanumeric, keyboard. The limitations of the Prestel database and the growing tendency to provide computing intelligence in the terminal effectively limit standards to screen formats and protocol. Prestel has also a well-established standard for communication between user terminals and the computer database, a prerequisite for public service.

36. *Private* viewdata systems may on the other hand be completely self- contained, users automatically dialling up their own computer databases. Except in West Germany, they are not obliged to use the PTT network. Although in theory they could operate to a completely different standard to the public system, compatibility is required for them to interact with multiple databases. West German experience indicates there is a major, growing market in such 'Gateway' facilities, and the basic Prestel systems are already being appropriately enhanced. A common standard is needed to permit communication between PTT-standard terminals and non-PTT databases, so it is likely that just one or two such standards will predominate in viewdata worldwide.

37. Two principal international fora for discussing viewdata standards are the 26 nation European Conference of Postal and Telecommunications Administrations (CEPT) and the Consultative Committee on International Telephones and Telegraphs (CCITT) on both of which country representation is today through PTTs. It is not however clear whether PTTs generally have sufficient commercial involvement in and commitment to viewdata to continue as sole negotiators. A third forum, which directs the joint teletext/viewdata standard, is the International Consultative Committee on Radio (CCIR).

38. Prestel-compatible systems are on trial or operational in at least 21 countries, many more than any competitor. UK manufacturers have generally accepted the Prestel Terminal Specification, thus providing a consistent approach when marketing abroad. The UK's lead in implementation means that it has now a considerable marketing investment dependent on the Prestel proposals. Consequently, a heavy responsibility is placed on BT to continue

to press for the international adoption and logical extension of their standard. The Department of Industry works closely with other interested parties to establish UK direction in co-ordinating international negotiations. Another encouraging finding was that follow-up funding from Government was not a problem.

39. Among the firms interviewed, there was on one hand general praise for the way in which the Prestel and teletext standards had been progressed to the point where the initial UK proposals had become the widespread de facto but basic standards. On the other hand, there was concern that early advice on business issues had not obviously been heeded, with consequent commercial confusion and lack of a clear upward growth path. Deviations from those early proposals were beginning to appear, for example identification by user not terminal and the introduction of intelligence and storage at the user terminal. There was comment too that the standards could have been better designed in the first place, and in particular that information processing considerations were subordinated to teleprocessing, and that the growth path as costs of information technology product components declined was unclear. Another concern expressed was the current absence of interfaces with related developments in IT, for example near term issues like word-processing compatibility and longer term developments of integrated telephone-answering, image processing and voice synthesis. The present standards are however capable of being enhanced to provide many of the features of competing proposals, and overall certainly do not appear to be constraining the commercial activities of suppliers.

40. CEPT has laid down an important consolidated European standard. This permits Prestel and a competing French system to co-exist and provide the environment for those requiring text with limited graphics, which is what European users appear able to pay for today, yet offers a route to high quality image handling, likely to gain commercial acceptance in say five to 10 years time. It has also has been proposed as a CCITT world standard.

41. The CEPT standard is also a candidate for the North American videotex standard. The main competitor here, a recent ATT extension of the Canadian Department of Commerce Telidon work, is incompatible with Prestel. If the ATT proposal prevails, the demand for viewdata products with downwards compatibility to Prestel so generated could be large enough for a separate commercial development, thus threatening UK opportunities for exports of current art viewdata products. Provided that the market demand is such that new users want to start with simple cheaper systems, a common world standard with Prestel at the low end of an upwards compatible hierarchy should

increase opportunities for the UK. It is however clear that, should that not occur, leading UK hardware manufacturers were fully prepared to implement the ATT proposal if market forces so required. The Japanese seem likely to continue to stand aside from standards harmonisation while the uncertainty inhibits design and manufacture in volume and then move into the world market place when things stabilise, perhaps through multi-purpose chips.

Standards and the design of videotex products

42. Success in marketing the CEPT viewdata standard abroad will open markets for UK products. The international success enjoyed by, and prospects for, UK teletext products provide a useful lesson on the effect of industry making a commercial commitment to a standard, associated with a drive for early market occupancy. In this respect it is noteworthy that the UK strongly influences the direction of world teletext standards, perhaps because it draws its international representation from industry.

43. It has been estimated that meeting standards for the suppression of electrical interference and radiation can add 1 – 2 per cent to manufacturing costs of videotex terminals, a negligible sum when set against the cost savings associated with product specification standards. There is a harmonised European safety standard, to which the UK national standard is matched as closely as possible, but national approval systems are lagging behind. With some electrical equipment, exports are inhibited by the refusal of some countries to accept the test results of others and in some instances countries insist on testing the production items, not simply the prototypes, thereby creating extra costs and marketing delays. But this was not a problem unique to videotex products.

44. West German regulation on modems was not a significant barrier to trade in terminals. In the US, a likely major videotex market, the imminent de-regulation of information technology and PTT products is being accompanied by vigorous ATT lobbying of the Federal Communications Commission, to the effect that the market should decide on standards following trials.

45. An important determinant in winning international acceptance for teletext was the definition of a full multilingual character set. It is noteworthy that this was instigated by the overseas parent of a multi-national company.

Standards and companies

46. There is no industry-wide quality scheme either for inspection of finished products or facilitating the purchasing of components. To achieve high levels of reliability of video products, such as television receivers, the failure rate of individual components needs to be only a few parts in a million. This is far more stringent than the concept and application of BS 9000. TV manufacturers instead rely on close collaboration with their components suppliers.

47. Safety standards similarly went beyond BS 415. Because each major TV manufacturer had sufficient purchasing power to insist on its own requirements, there was a barrier to the establishment of quality schemes encompassing the whole of the components sector. It was noted that there was a failure to protect national interests, eg by enforcing on importers the same stringent electrical supply management (full wave rectification) which British firms voluntarily implement, at consequent extra cost.

48. Regarding the quality of assembled videotex products, firms differed in the relative emphasis they gave to *product assurance* (designing and making it right in the first place) and *quality assurance*, that is checking performance once made. Not everyone understood the very considerable benefits of the former in the drive to produce zero defect, minimum cost products.

49. Notwithstanding initial success in promoting the Prestel standard, firms that regularly design for world markets must take account of international requirements to ensure thereby that their base products cover the widest possible target. Several of those interviewed also wished to participate more directly in the standards-making process and were concerned that BT was becoming the wrong group to represent UK viewdata interests. It was therefore encouraging to note that BT had itself recently been involving more industrial participation and that the vigorous activity shown by the relevant Trade Association in the appraisal and formation of videotex standards had been helpful to a majority of the firms visited.

50. Firms generally have little difficulty in obtaining information about overseas standards and specifications, perhaps since videotex had grown from a UK base. Nevertheless, obtaining translations of standards published only in the original language was not only tedious but also resulted in important subtleties being lost in translation. The larger enterprises interviewed maintain comprehensive, fully documented and internally widely available collections of all the national requirements potentially affecting their products. One of these had in addition highly developed management procedures for ensuring

that decisions were made about meeting various overseas requirements at milestones in the design and development process. Other, smaller, firms necessarily do this in a less structured way, frequently through a nominated standards executive working with a relevant trade association and with professional contacts overseas.

51. Every one of the companies visited considered that keeping track of overseas standards was a major market research issue. Standards compliance on the other hand was a key line responsibility, invariably attracting close management attention. Even the smallest of the companies visited had full time standards management which in every instance reported high in the organisation.

52. Each, too, demonstrated commitment to in-house training in, as well as maintenance of, a positive cultural attitude towards design standards and associated subjects such as quality, reliability and safety. Compliance in these areas consumed at least 8 per cent of turnover, with considerable net benefits. In-house training was felt to be the only way through which standards and regulations could be fully absorbed into the real life context of firms' commercial activities. Although the awareness that standards and regulations did affect design might be taught to effect in university courses, it was felt that tuition on eg quality management could be counter-productive unless closely related to real-life company activities.

Conclusion

53. Standards affect the development of the videotex sector in several ways. *First*, although customer needs and technical ingenuity are powerful driving forces, manufacturers cannot justify major investments in new technology without the confidence that there will be economies of scale. Widespread acceptance and implementation of basic standards is essential to the creation of large markets, because this opens up the possibility of high production volumes. In particular, international markets for videotex products and information services based on videotex depend on the adoption of European (CEPT) and international standards for telecommunications protocols, terminal displays and the Gateway function. For all these standards, manufacturers need some assurance that they will be functionally stable for a while. There are major export opportunities here for the UK, but to achieve their potential will require business and political commitment as well as technical strength.

54. *Second*, the procedures for assessing the compliance of videotex products with safety standards are no different from those for other information technology products selling in a higher price bracket. Differing national requirements for product certification and approval add to product development costs and make it harder to bring down selling prices to levels at which a consumer mass market is likely to appear.

55. *Third*, all the parties with an interest in the development of this sector need to work together on the definition of international standards and mutually recognised certification procedures – PTTs, manufacturers, component suppliers, information system suppliers and customer interests.

INDUSTRIAL FASTENERS

56. The British industrial fastener industry dates back to the industrial revolution. Industrial fasteners are a basic and integral part of virtually every manufacturing process. The major markets for the industry are automotive, aerospace, defence, building and construction, railways, mines and consumer durables. The industry had a recorded turnover of £400M in 1980 which is a considerable reduction in real terms from 1974 when the turnover exceeded £260M. The number of employees in the early seventies was 44,000 which has now reduced to less than 23,000. The import/export trends were largely in balance until 1976/77, but since that time net import penetration has risen to something like 25 per cent of the total domestic market. The marketing and selling of industrial fasteners is both direct from manufacturers to end users and, for about 40 per cent of production, through an extensive distributor network. All the companies interviewed export a significant proportion of their output.

57. To achieve more orderly trading conditions inside and outside the EC, the British Industrial Fasteners Federation (BIFF) established a quality assurance scheme in September 1980. The scheme, which was produced with considerable co-operation from BSI's Quality Assurance Division, was under the provision of BS 5750 Part II and relates to a system of determining the assessed capability of fastener manufacturers. Other benefits from the scheme were expected to include a reduction in multiple assessments, reduced insurance premiums, and a better understanding by fastener manufacturers of the merits of soundly-based quality assurance practice. Since the start of the scheme there has been growing acceptance from both the public and private sectors of the benefits to be derived from a well-promoted quality assurance scheme. In addition, industries peripheral to fasteners, such as

metal finishing and heat treatment are being involved in the basic fasteners scheme.

58. Regulations per se have very little direct influence on the fastener industry. Except in the fields of aerospace and structural steelwork, the effect of regulation or legislation is slight. However, regulations and safety legislation influence the design of fastening devices or systems, eg rivet setting machines, and since the higher added value end of the industry is moving more towards the production of special fastening systems, regulations must be expected to play a greater role in this area in future.

59. In contrast, the use of specification standards and systems standards is highly developed. The fasteners industry is mature and standards specifying the physical dimensions and properties of the product have existed for many years. More recently, systems standards have been developed to govern the processes and methods used in the production of fasteners.

Specification standards

60. Specification standards are a major influence on the design of fasteners. Indeed a very large proportion of the output of many companies in the industry comprises products which are designed to, and conform with, well established national and international standards. If anything, there is criticism of the multiplicity of different standards that have arisen for historical reasons, since this leads to some diseconomies of small batch production and high tooling costs. Much work is being undertaken on harmonisation and on the establishment of common ISO standards.

61. Metrication has had a major impact on the industry in the UK, although the standards problem was largely resolved by the adoption of ISO standards. With imperial fasteners gradually being phased out, the industry has resolved to freeze the imperial product standards and all new work, and harmonisation work, is on the metric standards. It was observed by several people that the old imperial British Standards eg Whitworth were tighter than overseas standards and that this led to some loss of competitiveness for the UK product. However, when unified and metric dimensions were adopted, the British Standards were based on existing ISO or overseas standards which had looser tolerances. Whilst there was criticism from some users, this meant that the British products could be competitive on non-price factors.

62. Although the industry is mature, new products are developed from time to time and are usually brought into the standards system. Normally a new product is patented, and the inventor then licenses manufacture to companies round the world. Standards are developed when the patents on the proprietary product are running out and they usually embody the technical features of the patented product.

Standards-making

63. At the present time UK standards-making for fasteners is driven by external factors. The requirement for new British Standards comes principally from the ISO, but this may reflect the present concentration on metric standards. Standards for aircraft fasteners are principally influenced by US practice. The manufacturers have traditionally played a very major part in standards-making in the UK. Indeed the role of the BSI is minimal and in the past the draft standards have often been written by the staff of one leading manufacturer. However leading producers are cutting back their commitments to the fasteners industry and now play a less dominant role. BIFF have established a standards committee and this is now playing a role in co-ordinating industry views on standards. This is beneficial in that it provides a broader industry view on standards than previously.

64. British standards-making practice compared unfavourably with that overseas, particularly in West Germany and the USA. In the UK, users play virtually no part in the standards-making process. In contrast, in West Germany the standards are usually drafted by DIN staff, who also play a very active role in ISO, and users participate fully. The West German standards-making process is also supported by substantial research effort at the Technical University of Darmstadt, which is funded both by the West German government and the fastener industry. No such technical support is available in the UK other than that from certain manufacturers (now heavily curtailed).

65. UK practice also varies from that in the US. In the UK, it is usual for a company standard to be adopted directly as a draft British Standard. In the USA, the fastener industry trade association (IFI) has a strong standards-making function. At an early stage in product development, they establish an industry (IFI) standard which, after some experience, is later adopted as a National standard. The strong technical directorship at the industry level represents the US at ISO committees.

International standards

66. Manufacturers and BIFF also play an active role in international standards-making, sitting on ISO committees. It was observed that participation from some overseas countries, particularly West Germany and the US, had been more consistent than that from the UK and that this had been beneficial to those countries obtaining acceptance of their views in the establishment of ISO standards. Although the Department of Trade presently finance the travel costs of the head of a UK delegation to an international standards forum, more assistance should be provided for UK participation in international standards-making because harmonisation of standards would be beneficial to the UK industry. There is often difficulty getting consensus at ISO and this had led on occasions to the adoption of dual standards. Whilst this does not exactly represent adoption of the lowest common denominator, it is not seen as good or helpful practice by UK manufacturers. Again, UK user participation is minimal and, typically, it was noted that a major multinational was represented on an ISO committee by staff from its West German operation.

Systems standards

67. The UK fastener industry has established a lead in the use of systems standards. Whilst the scheme had been expensive for several companies to adopt, it is starting to prove beneficial in reducing the number of assessment schemes in which they had to participate. Having established the scheme, BIFF are now finding much interest from overseas, particularly from Europe. Most of the respondents felt that some form of official backing or recognition for the scheme would assist its acceptance by UK and overseas customers.

Regulations

68. Regulations play a relatively small role in the fasteners industry. However several respondents felt that the introduction of product liability legislation, which is expected to have a significant impact on the fastener industry, may lead to greater use of regulation governing the use of fasteners.

Customer assessment schemes

69. Customer standards and assessment schemes have far greater influence on fastener producers than national regulations. Indeed, all the companies interviewed complained of the heavy cost of meeting a variety of customer assessment requirements. Typically, a medium sized company with 3–400 employees would have to employ one or two qualified personnel solely on the administrative requirements of customer assessment. This represents a significant cost. In particular, the motor vehicle industry is a problem area.

Fastening systems

70. One area where regulations affect the fastener industry is that of fastening machines. Several companies market not only their fastener product, but also the machinery for applying the fastener. These machines, or systems, may be sold or rented to the customer and have to comply with the factory health and safety regulations in the customer's country. In the UK, the machinery producers have established a close, but informal, rapport with the Health and Safety Executive to ensure that products meet the necessary safety requirements. Importers can bring in competitive products without meeting any formal criteria, although the ultimate user has to ensure that the imported machines are adequately guarded and safe.

71. However, when such fastening machines are exported to West Germany, they have to be approved and receive the GS mark before they can be sold to the industrial user. This certification process is expensive and, although there is no inference that West German safety standards are higher, to meet the West German requirements, West German electrical and pneumatic components have to be incorporated in the design.

Influence on companies

72. All companies in the fasteners industry have long existed in an environment in which standards requirements dominate. Hence, thinking and understanding of standards is fully integrated into the marketing, design and production operations. In several of the companies the technical and marketing functions were closely allied and reported to the same executive. Two companies mentioned that they had used the Technical Help to Exporters (THE) service when they had found their own resources inadequate, although they thought the service expensive. Typically the costs of standards and qua-

lity assurance work were thought to represent about 25 per cent of total design and development costs.

73. Quality assurance techniques are equally well integrated into company practices. The companies interviewed all employed quality assurance and inspection staff, often with the Quality Manager reporting directly to the Managing Director. Respondents felt that emphasis on quality assurance was likely to increase in the future and will require additional company resources. In view of the limited impact of regulation on the fasteners industry, no assessment could be made of the costs of product certification and approval.

Training

74. Companies gave no special training in standards or regulatory work. Designers are recruited largely on the basis of their design skills and are expected to pick up knowledge on standards as they work. Likewise marketing staff, who are usually technically qualified, are expected to acquire their knowledge about standards on the job. Only in the area of quality assurance techniques is training routinely given to staff, particularly in the production departments. This higher level of training may be a transient phenomenon whilst the BIFF quality assurance scheme is introduced by most firms in the industry. No strong views were expressed about the adequacy, or otherwise, of standards training in the technical education system.

Conclusion

75. The fasteners industry is a mature one in which national and international standards play a significant role in the design and marketing process. Use of standards is fully accepted in the design process. As yet, regulation and legislation have had little effect on the industry apart from some relatively small product sectors, although this may change as product liability legislation is introduced. With the move to metric standards in the 1970s, Britain's role in specification standards-making has diminished, and British standards are now led by other national and international standards. In contrast, the UK fastener industry has recently, and successfully, introduced their sectoral quality assurance scheme based on BS 5750, and hopes that this will form the basis for similar international schemes. Introduction of this has improved the industry's quality standards and competitiveness. This scheme presently has no official backing or recognition, although this would be welcomed by the industry.

METAL AND PLASTIC WINDOW FRAMES

76. Plastic and metal windows were selected for study as examples of an internationally tradable building product. Detailed discussions were held with 9 manufacturers of aluminium, steel, plastic and wooden window frames and also with a glass manufacturer, trade organisations, architects and major public purchasers.

77. The market for plastic and metal windows amounts to almost £600M pa. Plastic windows are almost all sold for home improvement. Steel windows are sold unglazed and all go to the specifier market. Aluminium windows, normally glazed, have the lion's share of the market. For metal and plastic windows 80 per cent of sales go to home improvement with the remainder to the specifier market. Although in this study we have focussed attention on metal and plastic window frames, we acknowledge that timber window frames still dominate the United Kingdom market, particularly for new houses.

78. *Aluminium* windows have at present a market penetration far exceeding plastic or steel frames. Although most of the specifier companies are members of the Aluminium Window Association and conform to its code of practice, this does not apply to the many hundreds of companies producing windows of variable quality for the home improvement market. The AWA was formed partly to develop a British Standard for aluminium windows (BS 4873) and has sponsored a quality assurance scheme for about 10 years.

79. The production of *steel* windows requires an extensive set of rolls with different profiles. Development of new sections is expensive and time-consuming. The 'standard' windows reflect BS 990, substantially unchanged since 1941. All sections sold in the UK (about 10,000 tons pa) are produced by Darlington and Simpson Rolling Mills Ltd (owned jointly by BSC and Norcros). In the UK, Crittall (also owned by Norcros) is the market leader with about 70 per cent. Although 'standard' windows with double glazing and built-in draught strip are not fully developed, the high security and integrity of steel windows together with their desirable and wide range of finishes, suggest they should at least retain their UK market hold. At present there are no imports of steel window sections but in the export market (particularly the Far and Middle East) there is strong competition from a Belgian supplier as well as poor quality but low price products from China and India. However United Kingdom exports, at 75,000 tons pa, are many times the size of the home market.

80. *Plastic* windows have been available in the UK for about seven years but significant sales have only been achieved in the last two. The United Kingdom market, almost all in the home improvement sector, was valued at about £40M pa at the end of 1981, and doubling annually. The present market share of between 1 and 2 per cent falls well short of West Germany where plastic windows have about 50 per cent of the total market. A lack of firm evidence about their long-term performance in use is probably the main reason why they have not been specified for 'institutional' buildings. The technology was developed in West Germany and most plastic windows in the UK are made under licence and consequently conform to the relevant DIN standards. Several major companies manufacture profiles in the UK while a large number of smaller companies import them from Europe, particularly West Germany. Exports of plastic windows from the UK are insignificant at present and are unlikely to grow within Europe where there is currently overcapacity. The British Plastics Federation has 40 companies in its British Plastic Windows Group but the large number of West German importers are not members. The Group is currently preparing a draft British Standard for plastic window frames.

British Standards and regulations

81. In the window sector, British Standards are considered to have a minor influence on the product. There is not yet a standard for plastic windows, but for aluminium and steel the British Standards are seen as guidelines to a respectable product. Indeed, conformity with the standard does not impose any cost penalty as the design and manufacturing procedures of the reputable companies lead to a product at least meeting if not exceeding the British Standard. Experience has shown that standards rarely change, perhaps every ten years or so, although currently a new range of standards is being developed. There was widespread criticism of a new performance standard for windows directed mainly at the lowest grade of performance, that of a basic timber window frame designed long ago to meet a very different need. It is clear that the development of this standard does not reflect the consumers' interests in performance, durability and maintenance but those of the manufacturers and bodies such as the NHBC whose interests are not directed towards lifetime costs issues.

82. Architects varied considerably in their use of British Standards and their awareness of the role that standards do or can play in specification. In some cases, specifications are unnecessarily demanding in order to provide a measure of professional indemnity. Enhanced standards with a 'deemed to satisfy'

legal status for product liability would lead to improvements in quality and overall costs.

83. All manufacturers were in favour of British Standards having higher status and their wider use in public purchasing. A stronger Government presence on BSI committees should help standards meet consumers' requirements, encourage the use of standards for public purchasing and reduce the need for manufacturers to adapt their product to meet the differing needs of major public purchasers (eg PSA/DHSS/GLC). In turn the widespread use of British Standards for public purchasing (whether or not mandatory) would ensure that they meet users' needs. A stronger input from consumers would help to resolve issues between competing interests; for example it was claimed by window manufacturers that the glass industry had pressed for a higher requirement than was necessary for the glass in patio doors whereas a specifier claimed that frame manufacturers had sought to reduce the safety margins for glass to too low a level.

84. Building Regulations are concerned with the health and safety aspects of buildings together with the conservation of energy. A revision to the Regulations was published during our study, but there was little awareness of it. The Regulations make some reference to British Standards. It was generally held that the regulations only set minimum requirements and provide no incentive to manufacturers to improve the performance of their products. Such an incentive was felt necessary so that manufacturers could more easily concentrate on export markets where the performance requirements are frequently higher than in the UK. The Building Regulations limit window area in thermal conductivity terms. No allowance can be made for passive gain and the frame does not have to meet insulation or water ingress requirements. The development of Building Regulations was considered most unsatisfactory: the process is perceived as inaccessible, there is little feedback and in general the Regulations are inert. In addition, their interpretation varies from one part of the country to another. They are not concerned with fitness for purpose. There is nothing to prevent the replacement of existing windows with others which at the time of construction would have been deemed unsuitable.

85. An indication of the potential value to the manufacturing industry of regulation, and to some extent public purchasing, came from the GLC which, within the Inner London Education Authority (the old LCC area) administers the GLC Regulations. These apply to both public and private building, valued at about £1,000M pa. About 50 per cent of the components of buildings are covered by the Regulations. The confidence in the regulations used and administered by the GLC is reflected in their adoption elsewhere, not only in

the UK but in many parts of the world. For example, GLC Regulations have been included in Japanese standards. The European Local Authorities Association (STCELA) recognise that their purchasing power – in excess of the GNP of Holland – could be used to assist EC industry and, taking note of several UK models, is giving consideration to central purchasing.

Certification

86. Conformity with BS 4873, in the case of aluminium windows, is certified by the BSI *Kitemarking* Scheme. However, very limited use is made of Kitemarking in the window frame market. A Kitemarked double glazing unit can be built into a most unsuitable frame which, for example, might allow water ingress to the edge of the glazing and so erode the value of the certification. The method of regular inspection was seen as hardly adequate, being based on a BSI inspector removing one or two samples per year for further testing. One manufacturer held the view that Kitemarking is not relevant to selling its windows to the specifier market where the manufacturer's name is already well known. But other companies considered that certification is a key non-price factor in marketing. However, the costs of Kitemarking are such that only those products likely to secure a high volume of sales are included in the scheme. Other products by the same manufacturer are claimed to be 'up to Kitemarking Standards'. There is also a third party certification scheme for plastic windows based on BS 5750.

87. When a new product is not covered by an existing British Standard it can be submitted for an *Agrement* Certificate. Window manufacturers, in principle, were in favour of the Agrement system but considered, with the present arrangements, that the status of the certificate is too low and the time taken for assessment excessive. They believed that the low status of Agrement came about because the certificate does not have a 'deemed to satisfy' status.

Exports

88. *Europe* was not regarded as a worthwhile market for UK style windows because of our requirement for a generally lower level of performance. Certification is required for any window sold in Germany and difficulties, amounting to a non-tariff barrier, have been reported in regard to the testing method for wire reinforced glass. *North America* is not a traditional market for UK window manufacturers but currently the sales of plastic windows are increasing steadily even though, by tradition, USA windows are of relatively poor

quality. In the USA, separate certification is needed in each state. Plastic windows reached Canada even more recently than the UK but, it was claimed, a standard has been produced in only 4 months. The same standard has been accepted in the USA by the Housing and Development Agency.

89. Sections for steel window frames are a major export to those countries where, in the past, there had been a British administration, such as in the Far and Middle East. There is strong and increasing competition from other European and local manufacturers and cheap imports from China and India. In recent years, new specifications have tended to favour local manufacturers but many still follow BS 990. Nevertheless one British company planned to work with the overseas regulation and standards bodies to develop mutually acceptable standards and, where new sections are necessary, to develop these jointly with the customer.

90. Manufacturers need a product which meets a large home and overseas market requirement to keep unit costs to a minimum. Reconciliation of United Kingdom and overseas standards would obviate the need for the UK manufacturers to respond to an enquiry set in terms of an overseas standard by reference to the nearest British Standard. The wider use of British Standards for public purchasing would raise their credibility and lead to some countries, particularly those with close UK connections, making more use of British Standards as a basis for purchasing. In this context a reduction in the number of overseas students in the UK universities would reduce the international awareness of British Standards.

91. Most overseas sales of window frames from the UK, particularly in the aluminium sector, arise from UK contractors which also prepare the specification. Window manufacturers claimed that UK architects fail to recognise the available UK products and the technical limitations which constrain their response to special requirements. We were repeatedly told by specifiers, who operate at the high performance end of the range, that UK suppliers had in recent years lagged behind foreign manufacturers of frames and curtain walling in their ability to meet specified needs. Not only was their sales force less technically aware of the manufacturing process and capability but the UK manufacturers did not have the tooling or development support capable of producing features available overseas; for example, the pressed aluminium cladding for the fourth terminal at Heathrow airport. The regulation of window frames was seen as a means of encouraging manufacturers to recognise customer requirements and at the same time reduce the threat of sub-standard imports.

Quality assurance

92. Like standards, quality assurance schemes are underwritten by window associations. However they were not believed to have helped exports or reduced imports. Little awareness of BS 5750 was detected but one company said it would use the Standard in manufacture if there was a requirement from customers. A major purchaser said that adoption of the standard would be a valuable aid in assessing manufacturing quality. In the home improvement market a listing of quality assessed manufacturers would be welcomed as it would enable purchasers to avoid low quality installers.

93. There is increasing awareness, particularly in institutional buildings, of the lifetime costs of windows and building hardware. The significance of maintenance and energy losses is illustrated by the case of a major purchaser whose maintenance costs were three times greater than new building costs each year. In a study of alternative window systems for a particular institutional application, the life costs of windows based on different types of frame varied by a factor of two.

Innovation

94. As with other building products where durability is a key requirement, the mechanism for launching a new product is not easy. Unless the product can be regarded as 'fit for the purpose', there is little hope of success. In principle an Agrement type of certification, enhanced with 'deemed to satisfy' status, would meet this requirement. The low standards of heat insulation required by the Building Regulations for windows in the UK do not encourage innovation and inhibit exports to those countries having higher standards.

95. The GLC is one of the few authorities whose practice takes account of innovation. At the discretion of the District Surveyor new products not conforming with existing regulations can be introduced. The extensive GLC testing facilities examine new products on a 'fitness for purpose' basis which clearly assists innovation. However the GLC Regulations can inhibit innovation if they simply add to the different requirements which manufacturers have to meet. Public purchasing to a common set of requirements, such as an effective British Standard, would be a helpful rationalization.

Conclusion

96. In the window frame sector, differing national requirements are identified by individual companies, supported by trade organisations covering aluminium, steel and plastic windows. The codes of practice or standards underwriting UK requirements do not affect the cost of the product. At the most, standards are seen as guidelines to a respectable product and in some cases they are regarded as the lowest common denominator. Within the UK, the interpretation of Building Regulations, which are supported to some extent by British Standards, varies from one part of the country to another. Major specifiers, eg the PSA, DHSS, Home Office, GLC, set their own requirements. A common standard embracing several different levels of performance would, if adopted by manufacturers and customers, assist manufacturers in defining the market for new products.

97. As with other building products where durability is also a key requirement, the mechanism for launching a new product is not easy. In principle an Agrement type of certification, enhanced with 'deemed to satisfy' status, would meet this requirement. The low standards of heat insulation required of UK windows do not encourage innovation and inhibit exports to those countries having higher standards.

98. Most exports from the window sector are generated by major contractors who often specify in terms of what is available in the UK. Whether exporting directly or on the back of a major contractor, there is evidence that manufacturers attempt to identify the environment and any local regulations pertaining to window frames. Use is made of British Embassies, THE, and BOTB for initial contacts but it was generally held that detailed information and the development of a working relationship with the customer or regulatory body requires overseas visits by the company. In the sector there is a noticeable tendency, due to the low importance attached to direct exports, to disregard specifications in the form of other bodies (eg DIN) but to tender using the nearest British Standard.

Annex D

List of organisations and individuals submitting evidence

Agrement Board
British Standards Institution*
BP International Ltd
Civil Aviation Authority
Confederation of British Industry
Cranfield Advisory Group on Design
Department of Industry
Department of Trade
Design Council
Health and Safety Executive*
Institute of Quality Assurance
Institute of Purchasing and Supply
Institution of Civil Engineers
Institution of Chemical Engineers*
Institution of Electrical Engineers
Institution of Engineering Designers
Institution of Mechanical Engineers
Institution of Production Engineers
Leyland Vehicles Ltd
National Economic Development Office*
Royal Aeronautical Society
Triplex Safety Glass Co Ltd*
Mr A B Cameron*
Dr G B R Feilden*
Mr L Gosland
Mr C S King
Mr V J Osola*
Sir Frederick Warner*

*provided oral evidence

(This list does not include those interviewed during the product sector studies)

Annex E

List of abbreviations

ACARD	Advisory Council for Applied Research and Development (UK)
AFNOR	L'Association Francaise de Normalisation
ANSI	American National Standards Institute
API	American Petroleum Institute
ASME	American Society of Mechanical Engineers
ASTA	Association of Short Circuit Testing Authorities (UK)
ASTM	American Society for Testing Materials
ATT	Associated Telephone and Telegraphs Inc (USA)
BASEC	British Approvals Service for Electric Cables
BASEEFA	British Approvals Scheme for Electrical Equipment in Flammable Atmospheres
BBC	British Broadcasting Corporation
BCS	British Calibration Service
BEAB	British Electrotechnical Approvals Board
BEAMA	British Electrical and Allied Manufacturers' Association
BIFF	British Industrial Fasteners Federation
BOTB	British Overseas Trade Board
BS	British Standard
BSC	British Steel Corporation
BSI	British Standards Institution
BT	British Telecom
CAA	Civil Aviation Authority (UK)
CCIR	Consultative Committee for International Radio
CCITT	Consultative Committee for International Telephones and Telegraphs
CEN	European Committee for Standardisation
CENELEC	European Committee for Electrotechnical Standardisation

CEPT	Conference of European Post and Telecommunications Authorities
DHSS	Department of Health and Social Security (UK)
DIN	Deutches Institut fur Normung (West Germany)
DOE	Department of the Environment (UK)
DOI	Department of Industry (UK)
DOT	Department of Trade (UK)
DTp	Department of Transport (UK)
EC	European Community
ECE	Economic Commission for Europe (United Nations)
EESR	Electrical Equipment (Safety) Regulations (1975)(UK)
EFTA	European Free Trade Area
FM	Factory Mutual Research Corporation (US)
GATT	General Agreement on Tariffs and Trade
GLC	Greater London Council
HSE	Health and Safety Executive (UK)
HSWA	Health and Safety at Work etc Act
IEC	International Electrotechnical Commission
IEE	Institution of Electrical Engineers (UK)
ILEA	Inner London Education Authority
IP	Information Providers
ISO	International Standards Organisation
IT	Information Technology
ITV	Independent Television
JCII	Japan Camera Inspection Institute
JIS(C)	Japan Industrial Standards (Committee)
JSA	Japan Standards Association
LCC	London County Council
LVD	Low Voltage Directive
MITI	Ministry of International Trade and Industry (Japan)
MOD	Ministry of Defence (UK)

NATLAS	National Testing Laboratory Accreditation Scheme(UK)
NEDC	National Economic Development Council (UK)
NEDO	National Economic Development Office (UK)
NEL	National Engineering Laboratory (UK)
NPL	National Physical Laboratory (UK)
NWML	National Weights and Measures Laboratory (UK)
ppm	Parts-per-million
PSA	Property Services Agency (UK)
PTT	Post and Telecommunications Authority
QAD	Quality Assurance Division (BSI)
SAE	Society of Automotive Engineers (US)
STCELA	European Association of Local Authorities
THE	Technical Help to Exporters (UK)
UL	Underwriters Laboratories Inc (US)

Printed in England for Her Majesty's Stationery Office by Commercial Colour Press, London E.7.
Dd.697858 C30 6/82